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Fifth Report of the Task Force on the

Shuttle-Mir

Rendezvous & Docking Missions

September 21, 1995

A Task Force of the
NASA Advisory Council

FIFTH REPORT

OF THE

NASA ADVISORY COUNCIL
TASK FORCE ON THE SHUTTLE-MIR
RENDEZVOUS AND DOCKING
MISSIONS

September 21, 1995

THOMAS P. STAFFORD
1006 Cameron Street
Alexandria, VA 22314

September 21, 1995

Dr. Bradford Parkinson
Chairman, National Aeronautics and
Space Administration Advisory Council
National Aeronautics and Space Administration
Washington, DC 20546-0001

Dear Dr. Parkinson:

In response to your letter of April 7, 1995,[1] requesting that the Task Force examine a number of specific issues related to the Shuttle-Mir program, I formed three small teams composed of Task Force members and technical advisors[2] to address the following issues:

1. Preliminary results from STS-71 and the status of preparations for STS-74.
2. NASA's presence in Russia.
3. NASA's automated data processing and telecommunications (ADP/T) infrastructure in Russia.

During the period between April and the July 19 Task Force meeting, these teams conducted extensive research. The teams presented their observations and suggested recommendations at the July 19 meeting. The Task Force approved and adopted the observations and recommendations presented by the three review teams. Accordingly, the three review team reports have been incorporated into the enclosed fifth report of the Task Force.

Please be advised that the Task Force will continue to review preparations for STS-74 over the next several months. I will convene the sixth meeting of the Task Force prior to the launch of STS-74 and will submit a report of the Task Force's findings.

Sincerely,

Lt. Gen. Thomas P. Stafford, USAF (Ret.)

Enclosure

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[1] Letter, Dr. Bradford Parkinson, Chairman of the NASA Advisory Council, to Lt. Gen. Thomas P. Stafford, Chairman of the NASA Advisory Council Task Force on the Shuttle-Mir Rendezvous and Docking Missions, April 7, 1995 (see Appendix 2).

[2] See Appendix 3 for a list of review team members.

cc:
NASA/HQ/Code A/Mr. Goldin
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NASA/HQ/Code AT/Mr. Mott
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Fifth Report: Task Force on the Shuttle-Mir Rendezvous and Docking Missions

Part 1: Recommendations

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Part 2: STS-71 and STS-74 Preparation Review Team Report, page 3	2-2.2.1	The R-bar approach is the preferred approach for operations such as the Shuttle-Mir rendezvous and docking missions.
Part 2: STS-71 and STS-74 Preparation Review Team Report, page 4	2-2.3.1.1	To minimize feelings of isolation among the U.S. crew when aboard the Mir station, efforts should be made to ensure that the U.S. crew are provided with dedicated air to ground communications time.
Part 2: STS-71 and STS-74 Preparation Review Team Report, page 4	2-2.3.2.1	To maximize interface opportunities between the orbiting Mir crew and the pre-launch Shuttle crew prior to Shuttle launches to the Mir station, efforts should be made to ensure that the crews are provided with additional communications opportunities during the weeks preceding the mission.
Part 2: STS-71 and STS-74 Preparation Review Team Report, page 6	2-2.6.1	In future discussions with the Russians regarding untended Mir station operations, particularly during Shuttle-Mir missions, NASA should stress the risks inherent in such operations and request that such operations be conducted only when necessary to conduct essential repairs or maintenance on the Mir station.
Part 3: Russian Review - Management Team Report, page 9	3-2.1.1	Develop written guidelines to enable the NASA Representative in Russia, once selected, to build a credible charter. To be most effective, the charter must clearly state that the NASA Representative in Russia: • Speaks for the Administrator on behalf of all NASA elements operating in Russia. • Has direct access to the NASA Administrator. • Advises the NASA Administrator and senior NASA officials on U.S. foreign policy objectives and Russian space developments as they affect NASA program activities. • Assures that the initiation, formulation, coordination, negotiation, implementation, and monitoring of bilateral and multilateral agreements with Russia are consistent with U.S. foreign policy and NASA program/project guidance. • Coordinates through the NASA Office of External Relations (Code I) for management of administrative and support functions in Russia. • Has the authority to remove from Russia any NASA civil servant or NASA contractor who exceeds the charter of his or her respective organization or who jeopardizes the Agency through his or her actions.
Part 3: Russian Review - Management Team Report, page 10	3-2.1.2	Complete the selection process for a NASA Representative in Russia with expanded responsibilities as soon as possible.
Part 3: Russian Review - Management Team Report, page 10	3-3.2.1	Each NASA organization operating in Russia must provide a charter for its activities to the NASA Representative in Russia. This charter must clearly spell out the scope of the organization's activities and the roles of any civil servants or contractors working in or traveling to Russia.
Part 3: Russian Review - Management Team Report, page 11	3-3.2.2	Each NASA organization operating in Russia must coordinate with, and provide regular status reports to, the NMLO regarding its activities in Russia.

Report Section, Page #	Recom. #	Fifth Report: Task Force on the Shuttle/Mir Rendezvous and Docking Missions PART 1: RECOMMENDATIONS
Part 3: Russian Review - Management Team Report, page 11	3-3.2.3	Each NASA organization operating in Russia should develop a plan to : • actively recruit qualified candidates; • offer the benefits (e.g., housing, home leave, differential pay, etc.) necessary to attract qualified candidates; • carefully screen candidates; • provide a career development path for each individual who chooses to serve; • ensure adequate language and cultural training (the National Foreign Affairs Training Center 44-week course is highly recommended by the Department of State and the Department of Defense); and • develop a pool of qualified and prepared candidates available to serve in Russia.
Part 3: Russian Review - Management Team Report, page 12	3-3.4.1	NASA should develop a comprehensive financial plan for NMLO operations and administrative support. NASA should also assign a budget expert at NASA Headquarters to support the NMLO/MTLO operation. This individual should have the authority to expedite solutions to the unique challenges facing that operation. Each NASA organization operating in Russia should be required to: • clearly spell out, in a written charter, the scope of its activities in Russia and the roles of any civil servants or contractors working in or traveling to Russia; • coordinate with and regularly status the NMLO on its activities in Russia; • allocate resources to the NMLO to cover administrative services.
Part 4: ADP/T Review Team Report, page 2	4-1.2.1	The Joint Institutional Communications Requirements (JICR) Working Group and Johnson Space Center (JSC) Institutional Communications Requirements (ICR) Panel should continue current processes until the U.S./Russian JICR Document is signed. A reasonable target date for signing of the document is July 28, 1995.
Part 4: ADP/T Review Team Report, page 2	4-1.2.2	The site-specific implementation plans should be finalized within a 6-week timeframe following RSA/NASA joint signing of the U.S/Russian JICR Document.
Part 4: ADP/T Review Team Report, page 3	4-1.2.3	PSCN should include instructions for users of institutional ADP equipment/software delivered to Russia as part of the deliverable Request For Service (RFS) packages. Training requests should be addressed on a case-by-case basis.
Part 4: ADP/T Review Team Report, page 3	4-1.2.4	Prior to implementation completion, a logistics and depot maintenance plan should be developed. From this plan, a funding profile should be developed.

Report Section, Page #	Recom. #	Fifth Report: Task Force on the Shuttle/Mir Rendezvous and Docking Missions PART 1: RECOMMENDATIONS
Part 4: ADP/T Review Team Report, page 3	4-1.2.5	A property control/inventory system should be developed for all equipment located in Russian and U.S. facilities, including portable ADP equipment located at the Moscow Technical Liaison Office (MTLO).
Part 4: ADP/T Review Team Report, page 4	4-1.2.6	The focal point of this activity will be in Russia; therefore, an Institutional Communications Director position should be established in Russia with the following major tasks: - Report directly to the NASA Moscow Senior Representative; - Responsible for the oversight of implementation of the site-specific plans; - Act as Contracting Officer's Technical Representative for O&M contracts; - Approve all changes to the signed NASA/Russian JICR Document; - Responsible for budget controls; and - Coordinate Russian activities with MSFC management.

Fifth Report: Task Force on the Shuttle-Mir Rendezvous and Docking Missions

Part 2: STS-71 and STS-74 Preparation Review Team Report

Results from STS-71 and Preparations for STS-74

September 21, 1995

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RESULTS FROM STS-71 AND PREPARATIONS FOR STS-74

1. BACKGROUND

In his April 7, 1995, letter[1] to Lt. Gen. Thomas P. Stafford, the Chairman of the NASA Advisory Council on the Shuttle/Mir Rendezvous and Docking Missions, Dr. Bradford Parkinson requested that the Task Force examine a number of specific issues related to the Shuttle-Mir program including the preliminary results from STS-71 and the status of preparations for STS-74.

Several of the Task Force members and technical advisors had already been monitoring preparations for the STS-71 mission since the inception of the Task Force in May 1994. Their initial observations and recommendations for STS-71 preparations were included in previous Task Force reports dated June 6, 1994, July 29, 1994, November 2, 1994, and March 1, 1995.

The Task Force STS-71 review team[2] reported to Gen. Stafford on June 28, 1995, that all outstanding technical issues regarding the mission had been resolved and that no safety of flight concerns existed. The STS-71 rendezvous and docking mission with the Mir station was highly successful.

At the July 19 Open Meeting of the Task Force, Mr. Tommy Holloway, in his capacity as Phase 1 (Shuttle-Mir) Program Manager, and members of the Phase 1 team presented a complete and thorough series of briefings which included preliminary results, lessons learned, and issues as well as preparations for STS-74. Mr. Holloway and his team professionally handled all questions and areas of concern raised by the Task Force and answered them in detail.

In reviewing the results of this mission, it should be noted that a priority structure, established prior to the Mir 18 main expedition/STS-71 mission, ranked the Phase I Program's mission goals as follows:

(1) Establishing working relationships between NASA and the Russian Space Agency (RSA).

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[1] Letter, Dr. Bradford Parkinson, Chairman of the NASA Advisory Council, to Lt. Gen. Thomas P. Stafford, Chairman of the NASA Advisory Council Task Force on the Shuttle-Mir Rendezvous and Docking Missions, April 7, 1995 (see Appendix 2).

[2] STS-71 and STS-74 Preparation Review Team members are listed in Appendix 3.

(2) Conducting risk mitigation activities which can provide meaningful results in a timely manner to have application to the International Space Station (ISS):
- Hardware performance evaluations
- Characterization of the Mir environment
- Joint science and mission operations; and
- Joint hardware integration.

(3) Gaining experience in long-duration operations in space and extended human space flight in preparation for the ISS.

(4) Providing an early opportunity to conduct scientific and technological research on a long-duration orbital platform.

The following observations and recommendations on the STS-71 mission and concerns for the upcoming STS-74 mission are based on the work performed by the Task Force STS-71 and STS-74 Preparation Review Team and the presentations made by the Phase 1 team at the July 19 Open Meeting.

2. STS-71 RESULTS

2.1. Loads and Dynamics

Observations:

There were no noticeable effects of Reaction Control System (RCS) plume impingement on the Mir solar panels during the approach. As expected, the desired radius vector (R-bar) approach required no braking during the approach. The one Primary Reaction Control System (PRCS) attitude correction firing inside 30 feet from the Shuttle and the Mir had no adverse results.

The preliminary estimated docking loads were well under the maximum allowable values (1,000 kg vs. 1,900 kg). Because contact misalignments were virtually non-existent, post-capture rotation (2 degrees) and stabilization time (60 seconds) were minimal.

A mated PRCS structural dynamics test was conducted as planned on flight day 5. Results proved that the mated stack structural characteristics were well within the pre-flight design margins, lending credibility previously developed, but as yet untested, to the engineering math models.

Shuttle Vernier Reaction Control System (VRCS) control performance of the mated stack was nominal. Stack stayed within plus/minus 10 degrees in all axes with very low rates as predicted. Propellant usage was higher than expected, but analysis of flight data and potential VRCS thrust model updates are in work. Mir control performance was also nominal,

but it too required more Mir PRCS firings than predicted to desaturate the gyrodynes. After one minor attitude trim, the stack was extremely stable in gravity-gradient operations.

2.2 Approach Profile

Observations:

The R-bar approach was flown to perfection by Commander Robert Gibson and the STS-71 crew. As expected, reduced up firing jets for braking resulted in the minimum possible plume loads and contamination on the Mir solar panels.

Recommendation 2-2.2.1

The R-bar approach is the preferred approach for operations such as the Shuttle-Mir rendezvous and docking missions.

2.3 Communications

Observations:

During STS-71, all Mission Control Center-Houston (MCC-H) to Mission Control Center- Moscow (MCC-M) voice loops functioned very well, and no outages occurred during the flight. The transfer of flight and experiment-related information during the mission continued to improve and provided an excellent example of successful joint operations. One communication-related concern which attracted attention was the reduced staffing of MCC-M on nights and weekends; however, solutions to this situation are currently in work.

For air-to-air communications, the Shuttle Very High Frequency (VHF) radio worked well with only minor noise and "vox" keying problems - both of which are being remedied. The window VHF antenna performed very well and will be used on STS-76 and subsequent Phase 1 missions. Air-to-ground communications were adequate with coverage provided by Russian ground stations with frequent supplementary coverage from both Luch communications satellites. When both satellites were providing coverage, nearly continuous coverage was available.

2.3.1 Observations: Dedicated U.S. Crew Communications

The one exception to an otherwise completely satisfactory situation was the lack of dedicated communications time for the U.S. crewman. This is a significant problem and an area worthy of some attention since dedicated communications time is essential to the U.S. crew aboard the Mir for completion of scientific and medical operations, psychological support

and alleviation of cultural isolation. Although weekly dedicated video communications sessions were planned during the Mir 18 mission, these sessions did not materialize until the end of the mission and were quite unsatisfactory in terms of frequency, duration and quality. Currently opportunities for such communications are limited since dedicated communication is only possible during passes over Russian ground sites. Depending on revolutions and orbital planes, there may be several hours when there is no communication with the ground. Satellite coverage is available, but not often, due to costs. As a result, U.S. communications using the satellite were hampered with time delays and poor voice circuit quality. In future missions, weekly dedicated video communications between the STS and Mir crews and appropriate ground personnel should be vigorously pursued.

Recommendation: 2-2.3.1.1

To minimize feelings of isolation among the U.S. crew when aboard the Mir station, efforts should be made to ensure that the U.S. crew are provided with dedicated air to ground communications time.

2.3.2 Observations: Dedicated U.S./Russian Crew Communications

Similarly important is the maximization of the interfaces between the Shuttle and Mir crews prior to the Shuttle launches to the Mir station. One way of accomplishing this is to increase the opportunities for the pre-launch Shuttle crew to communicate with the orbiting Mir crew in the weeks prior to the rendezvous and docking launch of the Shuttle. The STS-71/Mir 18 crews were awarded one crew-dedicated communication opportunity prior to the first Shuttle-Mir rendezvous and docking mission. Future Shuttle-Mir rendezvous and docking missions would benefit from an increase in such crew-dedicated communications opportunities.

Lack of dedicated communications time also limits opportunities for the U.S. and Russian crews to interface and the Phase 1 Science Program's Principal Investigators (PI's)/Scientists or their representatives to discuss requirements. In this instance, an expanded communications capability would ensure better integration of on-orbit work for both U.S. and Russian crews in near real-time, especially if ground training is less than originally planned.

Recommendation: 2-2.3.2.1

To maximize interface opportunities between the orbiting Mir crew and the pre-launch Shuttle crew prior to Shuttle launches to the Mir station, efforts should be made to ensure that the crews are provided with additional communications opportunities during the weeks preceding the mission.

2.4 Mir Electrical Power

Observations:

Adequate electrical power required continuous attention and often careful scheduling and prioritizing of activities during the Mir 18 expedition. Because of the Spektr and Kvant-2 solar array anomalies (described in section 2.7 below), the average solar array production was approximately 294 amps with an average bus load of 141 amps. A subsequent Extra-Vehicular Activity (EVA) on July 14, 1995, freed the blocked Kvant-2 array and deployed all but the fifth panel of the Spektr array. The current configuration is producing 450+ amps with a bus load of 160 amps. On the Mir station, there are now 31 batteries available with a total capacity of 1680 amp-hours, and more new batteries to be delivered to the Mir on STS-74 and STS-76.

2.5 Mir Cabin Leak

Observations:

On May 30, 1995, the Mir crew discovered a cabin pressure leak after Kristall was moved to the -Z axis of the transfer node. They located and temporarily fixed the leak by using tape, but the leak re-occurred causing the crew to move Kristall back to the -X axis on June 10, 1995, (10 days ahead of schedule) and the leak stopped. With the leak isolated to the -Z axis docking port of the transfer node, the STS-71 crew delivered a leak sealing kit and bolt tool to Mir. After an EVA inspection of the -Z axis port on July 14, 1995, Kristall was moved back to that port and no leak has been detected.

2.6 Untended Mir Operations

Observations:

On April 1995, the Russians proposed undocking the Soyuz with the Mir 19 crew, photographing the STS-71 undocking, and then re-docking the Soyuz to the Mir. Although this proposal presented no significant threat to crew safety, NASA Johnson Space Center (JSC) operations personnel and members of the Task Force were concerned with the possible inability of the Soyuz to re-dock with the Mir. Had Soyuz failed to re-dock, it would have returned to Earth and left the Mir untended for approximately two months. JSC operations personnel and the Task Force felt that there was some risk of losing the Mir station while it was untended since the station had recently required frequent inflight maintenance actions performed during the Mir 18 mission.

A decision was made, however, to undock the Soyuz prior to the STS-71 undocking for photographic documentation. While the Mir was unattended, an erroneous ground command from MCC-M computers caused a main flight computer shutdown which resulted in a Mir attitude control failure. The failure put the Soyuz re-docking at risk, but the crew

rapidly executed a successful manual re-docking with Mir in free drift ahead of the planned timeline. However, it is important to note that had this Mir attitude control failure occurred during the Shuttle approach, it would have prevented the Shuttle-Mir docking.

Recommendation: 2-2.6.1

In future discussions with the Russians regarding untended Mir station operations, particularly during Shuttle-Mir missions, NASA should stress the risks inherent in such operations and request that such operations be conducted only when necessary to conduct essential repairs or maintenance on the Mir station.

2.7 Mir Solar Array Status: Spektr Solar Array Release and Kvant-2 Solar Array Release

2.7.1 Observations: Spektr Solar Array Release

During deployment of the Spektr solar arrays, one of the four arrays failed to deploy automatically due to an incorrect sequence commanded by the ground computer. A single launch restraint (18mm aluminum tube with 3mm walls and deactivated external wires) had to be cut to free the array. The location and transition path provisions were limited, and standard Russian and U.S. tools would not satisfy the worksite reach and tube size requirements. Russian and U.S. tools were created, certified and flown on STS-71 (a one week U.S. effort). The Mir 19 crew was trained with the U.S. tool before leaving for the Kennedy Space Center (KSC) and a water tank test was conducted in Moscow using the JSC supplied tool for further verification. On July 14, 1995, the Mir 19 crew successfully used the U.S. tool to cut the restraint and allow the deployment sequence to continue. The actual cutting time was three minutes. As a result of this action, four of the five panels on the array deployed. The JSC and Russian teams are assessing the causes preventing full deployment of the array.

2.7.2 Observations: Kvant-2 Solar Array Release

During a Mir 18 EVA to relocate one Kristall solar array to Kvant-1, the Strela cargo crane was used to handle the stowed array. At the conclusion of this EVA, the end of the extended crane was improperly attached to Kvant-2 and blocked free rotation of the Kvant-2 solar array, limiting the power generating capability of the array. On July 14, 1995, the EVA crew corrected the cargo boom tether configuration which eliminated the interference problem and restored full rotation capability to the array.

2.8 Halon 1301

Observations:

RSA expressed a concern regarding a potential leak and use of the Shuttle's Halon fire extinguisher. RSA was concerned was that the high temperature of the Mir oxygen candle,

when burned, would break down the Halon gas leaked or released from the Shuttle fire extinguisher into a toxic product.

In response to this concern, JSC conducted a study, and provided data to RSA concluding that the concentration level would not create a toxic hazard. Procedurally, JSC proposed that, if the crew used Halon gas to extinguish a fire or detected a Halon leak, they would close the hatches to the Mir as soon as possible. This response was accepted by the Joint Flight Operations and Systems Integration Working Group (WG-3).

2.9 Androgenous Peripheral Docking System (APDS)

Observations:

The APDS docking mechanism performed flawlessly during the STS-71 mission. APDS kinematic and dynamic performance was monitored real-time during the mission using telemetry data. Recreated contact conditions based on vehicle state vectors and camera views showed that the Shuttle commander docked to Mir with near perfect performance as follows:

- Closing velocity 0.107 feet/second
- Lateral misalignment 0.7 inches
- Angular misalignment 0.4 degree/axis.

The correctness alignment resulted in a docking load of only 1,000 kg (load constraint was 1,900 kg) and this was dominated by the second phase of Post Contact Thrust (PCT) which occurred after capture.

2.10 Safety Certification Agreement

Observations:

Safety certification of all items to be transported in a pressurized volume to and from the Mir, and for experiment hardware operations onboard Mir and Shuttle, both docked and undocked, was an issue which threatened to consume considerable time and resources. Although both sides independently had thorough, extensive, proven criteria and processes to certify hardware for flight, the processes were often different from one another. In a commendable effort, RSA, RSC-Energia, and NASA developed an abbreviated payload safety assurance certification procedure. The fact that the experiment hardware and logistics were common to both the U.S. and Russian space programs and were developed in compliance with the space industry standards of each country assisted the real-time completion of this agreement. This agreement will result in a significant savings in time and resources and should be an example for further joint activities.

3. RESEARCH ON STS-71

3.1 Accomplishments

- Twenty-eight science experiments were conducted on STS-71, and common data sets were established which permitted previous Russian and U.S. data comparisons. The experiments spanned seven disciplines: metabolism, cardiovascular/pulmonary medicine; sensory-motor/neuromuscular studies; behavior and performance; hygiene, sanitation and radiation; fundamental biology; and microgravity. All science experiments performed during the Mir 18/STS-71 mission were successful. However, a few of the planned science experiments were pre-empted because of medical recommendations, hardware inaccessibility and the priorities of Mir operations and EVA activities.

- For the Mir 18 mission, joint U.S./Russian specialist teams trained the astronauts and cosmonauts to perform a comprehensive program of medical, biological and physical experiments. Many experiments utilized integrated systems of U.S. and Russian hardware/protocols to expand the research capabilities for Shuttle-Mir cooperative efforts. Three Progress vehicles and the Russian Spektr module transported U.S.-provided hardware to the Mir station.

- During the "docked phase," the Mir 18/STS-71 crews transferred approximately 450 items between the Shuttle and Mir. The Shuttle provided 1,067 pounds of water to the Mir (more than twice the amount originally planned).

- Baseline Data Collection (BDC) facilities were established at the Gagarin Cosmonaut Training Center (GCTC) in Russia. Over two tons of scientific hardware were shipped and assembled in order to conduct preflight physiological testing on the Mir 18 crew members and their backups. This hardware will also be used for data collection before and after future missions. In general, three preflight BDC sessions were conducted on each crew member. One session was held in the United States and two at the GCTC. BDC was performed by both U.S. and Russian investigators, as well as GCTC trainers.

- During the Mir 18/STS-71 mission, the crews collected the first U.S. long duration space flight data since Skylab. Most data/samples were recorded or preserved and returned to Earth, via the Space Shuttle, for post-flight analysis. Scientific data collection from long-duration Mir crew members was enhanced by intensive medical studies performed onboard Spacelab-Mir (STS-71), and preflight/post-flight data collection.

- Fifty-seven research sessions were completed on STS-71, which was 91 percent of the total sessions requested. Seventy-four science sessions were completed on the Mir 18 station with 100% of the environmental monitoring and fundamental biology sessions completed and 80% of the metabolic sessions completed. Losses in the cardiovascular and neuromuscular/neurosensory data were due to hardware inaccessibility.

3.2 Issues

3.2.1 Crew Training/Hardware

Observations:

Crew training, as originally negotiated, presumed on-orbit assignment of science via participation of U.S. crew and Russian crew in a ratio of 3 to 1 for the planned experiments. The training schedule in Russia, and to a lesser extent in the U.S., was preempted at times due to priorities associated with the training of the cosmonaut crew.

The documentation/certification process for the U.S. hardware and associated procedures also affected crew training. Due to difficulties and delays in the process, it was often difficult to provide proper fidelity training hardware in a timely fashion. This resulted in some inherent inflexibility and loss of efficiency and time in the crew training process. Additionally, once the training schedules are agreed upon, it is difficult to diverge from the schedule because of the attendant infrastructure of both the U.S. and Russian flight operations systems.

Lessons Learned

- Whenever possible, more active participation of the Russian cosmonauts would enhance the science program. With respect to training and crew participation, U.S. sessions with Russian participation should be augmented to optimize the procedure development and training quality. Specialized cosmonaut training should be provided, where possible, to optimize their overall scientific training. With respect to crew training hardware, delivery of all training hardware should occur as early as possible to facilitate adequate training; all engineering documents of the 100 series should be provided to the GCTC; and U.S. sessions with Russian participation should be augmented to optimize the procedure development and training quality. Cosmonauts should be invited and encouraged to participate more actively in the scientific protocols.

- Extensive consultation with Russian specialists should occur prior to finalizing hardware labeling. It is important to ensure that the training unit decal/labels are identical to the flight unit decals/labels. Temperature logs should be included in appropriate hardware shipping containers and preparations made to recover the experiment should the hardware be compromised by abnormal high or low temperatures.

3.2.2 Inflight Experiments/Hardware

Observations:

Because the Mir 18 Russian crew was busy with housekeeping operations and multiple EVA's to configure the Mir for the delayed Spektr and for the arrival of STS-71, there were periods of under-utilization for the U.S. astronaut and busy periods for the Russian cosmonauts. Due to the delayed arrival of Spektr to orbit, the research hardware was not available as previously planned. Hence, the Mir 18 crew--both cosmonauts and the U.S. astronaut-- were unable to complete the research planned for that portion of the mission.

In addition, several experiments in the Neurology/Cardiology areas were not completed during the mission, largely due to hardware unavailability. However, as mentioned previously, significant amounts of data were collected pre and post flight on the long duration crew, and baseline data collection capabilities in Russia were duplicated. All parties were satisfied with the science/medical data that was collected.

Lessons Learned

- As the lifetime of the Mir increases, the inflight requirements for maintenance can be expected to impact the crew's ability to accomplish science objectives.

- The Task Force feels that, when appropriate on future missions, the research program should be established quickly and mutually endorsed. Specific areas of endorsement should include the training schedule, customs clearance procedures, hardware acceptance and realtime planning and support plans.

- Dietary restrictions imposed by metabolic experiments should take into account dietary preferences of the participants.

- It is imperative that the Shuttle/Mir Research Program establishes a replanning mechanism to ensure that the U.S. crew is provided with sufficient experiments/hardware/work while aboard the Mir. Such replanning would minimize the impact of launch schedule adjustments on planned science/hardware availability.

In light of potential changes in the Russian Priroda module launch schedule, such replanning may be necessary to minimize research impacts on all subsequent NASA/Mir missions. The Priroda is carrying hardware for U.S. crew-operated microgravity science experiments for the STS-76 mission scheduled for March 1996. If the Priroda launches in March 1996 versus December 1995, as originally planned, the hardware will not be available, and if no adjustments are made, planned U.S. science will be impacted. NASA cannot expect to solve this problem with Shuttle manifest adjustments or ground training of the crew. Shuttle manifest adjustments impact all subsequent Shuttle missions, including those with international participation. Ground training of the crew is not a reliable alternative solution to this problem since this training is already limited by the amount and fidelity of the hardware as well as the limited availability of training time for both U.S. and Russian crews. For these reasons, the Shuttle/Mir Science Program should adjust its science/hardware requirements to the reality of schedule adjustments to ensure that the U.S. crew has sufficient experiments/hardware and work while aboard the Mir.

- The Russian lead timeliner who deals with the NASA Science Program is pivotal to implementing and scheduling flight activities. The U.S. representative must continue to establish a close and good working relationship with this person. Flight plans generated by TsUP representatives must be well coordinated with the Flight Data File (FDF) representative to ensure that experiment names on radiograms as consistent with the FDF.

3.2.3 Research-Related Communications

The Task Force's observations and recommendations regarding communications during STS-71 are presented in section 2.3 of this report.

4. MEDICAL OPERATIONS

4.1 Medical Communications

Observations:

A very good working relationship was established among the individuals working in the MCC-M during the mission, and the NASA medical support flight surgeons felt very much a part of the overall operational team. In addition, the NASA medical operations and science teams established an excellent working relationship. Both the science teams and the flight surgeons found the interaction and data sharing quite helpful. Given the benefits of such

collaboration, continued integration of the medical operations and science programs should be pursued.

The Task Force's observations and its recommendation regarding medical communications during STS-71 are presented in section 2.3 of this report.

5. STS-74 AND SUBSEQUENT MISSIONS

Based on discussions during its meeting on July 19, the Task Force identified the following as concerns for STS-74 and subsequent missions:

- ADPS Pyrotechnic Bolt Status;
- STS-74 Docking Module Berthing and Docking;
- Mir Electrical Power;
- EVA Plan for Risk Mitigation; and
- East Coast Abort Landing (ECAL) Sites for 51.6 degree Orbit Launches.

Fifth Report: Task Force on the Shuttle-Mir Rendezvous and Docking Missions

Part 3: Russian Review - Management Team Report

September 21, 1995

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1. NASA'S PRESENCE IN RUSSIA

1.1 Charter

NASA's cooperative efforts with Russian aerospace organizations, particularly the ambitious undertakings of Phase 1 and Space Station development, are unique in the Agency's international experience in both scope and depth. Given the critical nature of these efforts, the NASA Administrator and senior NASA management saw a need for an independent review of NASA's presence in Russia. As a result, the NASA Advisory Council (NAC) Chairman, Dr. Bradford Parkinson, requested that Lt. General Thomas P. Stafford, in his capacity as Chairman of the NAC Task Force on the Shuttle-Mir Rendezvous and Docking Missions, "review the overall NASA and associated contractor presence in Russia."[1]

In response to Dr. Parkinson's request, Gen. Stafford formed a team of Task Force members and technical advisors led by Col. James C. Adamson, USA (Ret.).[2] Between April and July, this team received briefings from, and conducted extensive discussions with, NASA managers, technical staff and contractors at NASA Headquarters, at the Johnson Space Center, and in Russia. The team also held discussions with State Department officials in Washington. In addition, the team met with senior officials at the U.S. Embassy in Moscow, as well as senior Russian officials in both Moscow and at the Gagarin Cosmonaut Training Center (CTC).

Based on these interviews, the review team prepared a series of observations and proposed recommendations which were presented by Col. Adamson at the July 19, 1995, open meeting of the Task Force. The observations and recommendations, as accepted by the Task Force members, are provided in sections 2 and 3 of this report.

1.2 Background

1.2.1 Establishment of the NASA Moscow Liaison Office and the Moscow Technical Liaison Office

In May 1994, NASA and the Moscow Embassy/Department of State completed an agreement for establishing a NASA office at the U.S. Embassy in Moscow. This agreement paved the way for NASA to establish the NASA Moscow Liaison Office and the Moscow

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1 Letter, Dr. Bradford Parkinson, Chairman of the NASA Advisory Council, to Lt. Gen. Thomas P. Stafford, Chairman of the NASA Advisory Council Task Force on the Shuttle-Mir Rendezvous and Docking Missions, April 7, 1995 (see Appendix 2).

2 See Appendix 3 for a list of review team members.

Technical Liaison Office (NMLO/MTLO) at the Moscow Embassy. The purpose of the NMLO/MTLO was to represent NASA and to provide needed policy, administrative and technical liaison support to NASA employees permanently or temporarily assigned to Russia in support of the Space Station Program, including Phase 1.

Under the NASA-Department of State arrangement, NASA's presence in Russia is sponsored by the State Department's Environment, Space and Technology section of the Moscow Embassy. NASA's presence in the Moscow Embassy is compatible with the National Security Decision Directive (NSDD)-38 and the NASA/Department of State Foreign Affairs Administrative Support (FAAS) agreement and subject to specific conditions, including the following:

- NASA personnel report to the Embassy Environmental, Science and Technology (EST) Counselor in Moscow and through the EST Counselor to the Ambassador.

- NASA-funded full time employees in Russia carry out the responsibilities associated with the assignment of diplomatic status and the title of attaché.

- NASA full time employees are evaluated by the EST Counselor in Moscow. This evaluation will be included as part of the overall performance evaluation done by NASA.

- NASA personnel work near or in the Embassy rather than at Russian institutes.

- NASA seeks Russian language training for the two NASA staff assigned to EST positions.

- NASA and the Department of State periodically review and, when necessary, amend the FAAS agreement for the provision of various services by the Embassy for NASA.

- NASA becomes part of the Embassy housing pool. As part of this pool, the Embassy will find apartments and negotiate and sign leases on behalf of the assigned NASA personnel.

- NASA staff arrives in mid-June 1994.

- The Embassy Budget and Fiscal office provides payroll servicing to NASA American and Foreign Service National (FSN) staff. NASA will use the Embassy's direct vehicle operations only for vehicle registration and obtaining local insurance for privately-owned vehicles and Government-owned vehicles. No other vehicle support will be provided by the Embassy.

1.2.2 Draft Memorandum of Understanding

The administrative and operational breakdown of responsibilities between NASA's Office of External Relations (Code I) and Office of Space Flight (Code M) has been defined in a draft Memorandum of Understanding (MOU) between them, and is reflected in the responsibilities assigned to the NMLO manager and the MTLO manager. In the proposed MOU between Code I and Code M, the NASA Moscow Liaison Office (NMLO) represents the interests of NASA Headquarters' Codes programmatically involved in Russia. *(The organizational structure of the NMLO and its primary interfaces and reporting paths are illustrated in Figures 1 and 2.)*

Under the terms of the draft MOU, Code I has responsibility for appointing a senior manager as the NMLO manager. The primary responsibilities of this position include:

- serving as the NASA Administrator's representative in Russia and the primary point of contact between the U.S. Embassy and all NASA personnel stationed in Russia;
- serving as the primary officer responsible for the NASA Administrator's visits to Russia;
- acting as the coordinator of the multiple NASA program representatives in Russia;
- assisting NASA in meeting its mission objectives through administrative functions such as letters of invitation for visitors, visa/passport issues (applications, extensions, multiple-entry, country clearance, etc.), customs (shipping/receiving issues), embassy FAAS agreements, NASA housing (leases, etc.), NMLO budget matters (planned annual expenditures and spending authorization, etc.) and office facility requirements for NASA support; and
- serving as the lead for NASA on Embassy issues and implementation of future joint programs with the Russians.

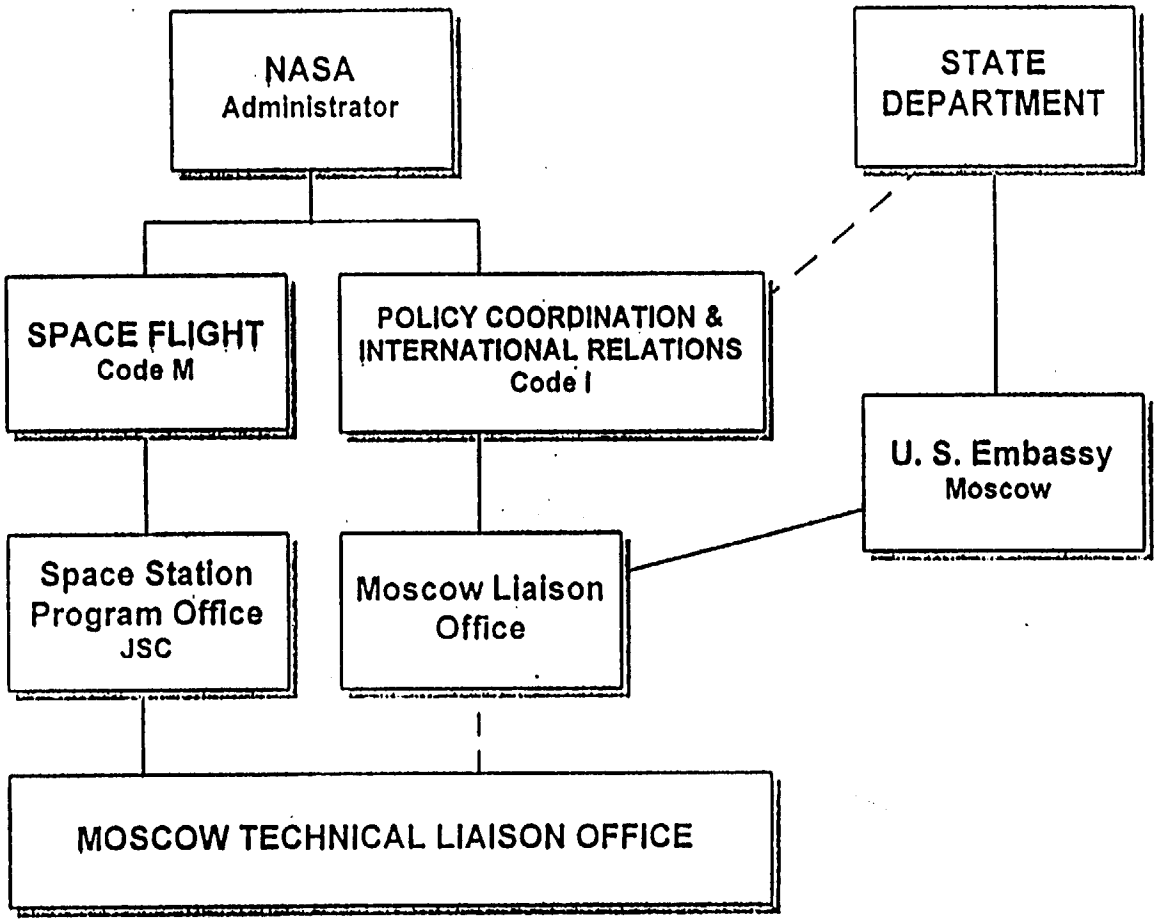
Under the guidelines of the draft MOU, the MTLO manager who is appointed by Code M:

- is administratively and technically responsible for the Space Station and Phase 1 personnel stationed in Russia; and

MOSCOW LIAISON OFFICE

FIGURE 1

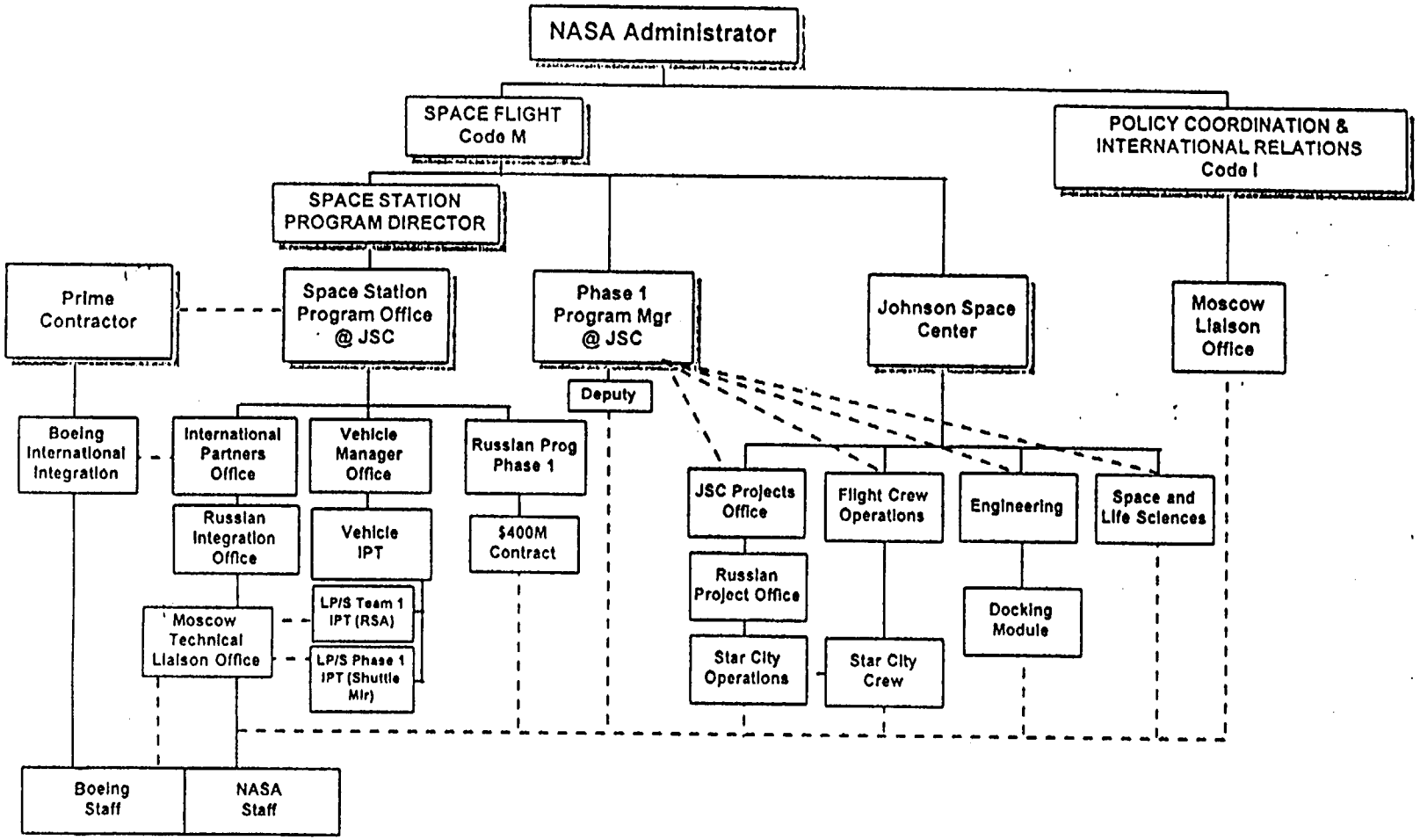
Organizational Structure



MOSCOW LIAISON OFFICE

FIGURE 2

Primary Interfaces and Reporting Paths



3b

- reports to Code M through the Space Station Program Office at the Johnson Space Center (JSC) regarding his or her assignment, but will receive direction from the NMLO manager on all administrative matters affecting the overall operation of the NMLO as agreed between Code M and Code I. *(The MTLO's primary interfaces and reporting paths are illustrated in Figure 3.)*

1.2.3 OSF Groundrules

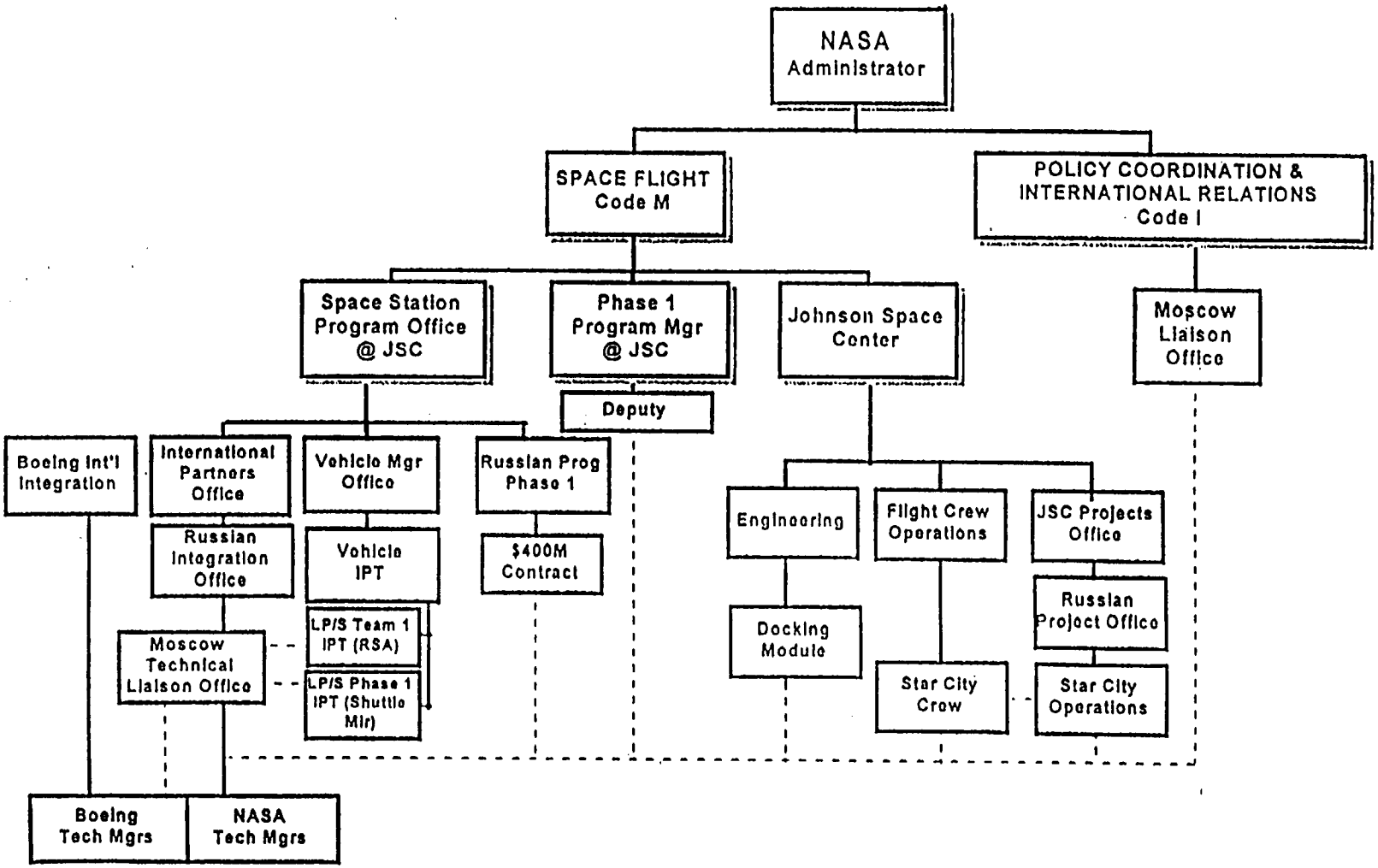
The administrative and operational groundrules for Office of Space Flight (OSF) employees located in the MTLO were defined by Dr. J. Wayne Littles, Associate Administrator for Space Flight, on February 21, 1995. Under these groundrules, OSF employees in Moscow administratively report to the (Code I) NMLO manager, (i.e., the NASA Russian Representative). At the same time, as de facto Embassy employees, OSF employees are required at all times to be responsive to the U.S. Embassy's directives, policies and requirements. Permanent NASA employees in Moscow on Space Station technical matters, including Phase 1, are operationally responsible to the MTLO manager. All other OSF employees in Moscow, i.e., those not directly assigned within the Space Station and Phase 1 program organizations, but working on Space Station or OSF matters are responsible for keeping the MTLO advised of their permanent plans, status and outcome of their activities.

1.2.4 Functions of the MTLO

In providing technical and administrative support to Code M's Space Station and Phase 1 programs in Russia, the MTLO:

- facilitates technical coordination between NASA's Space Station Program Office (SSPO) in Houston, the Russian Space Agency (RSA) and their contractors;
- performs program management and technical liaison between NASA and RSA;
- monitors and reports on the implementation of the Space Station Baseline;
- assesses progress on joint program objectives;
- facilitates technical coordination between NASA and RSA and their respective Space Station program contractors;
- serves as the designated NASA representative on the RSA Scientific Technical Board Meetings and other activities considering ISSA issues; and

FIGURE 3 MOSCOW SPACE STATION TECHNICAL LIAISON OFFICE
Primary Interfaces and Reporting Paths



- provides additional services to NASA's Space Station and Phase 1 Program personnel in Moscow including support for administrative functions such as transportation and accommodation arrangements, letters of invitation, and visas. These services have been used by other NASA organizations outside of Space Station.

1.2.5 NMLO Representative Position Description

The NASA Russian Representative, as defined by Code I, reports to the Director, of NASA Headquarter's International Relations Division. The position description for the Russian Representative notes that he or she is responsible for monitoring and implementing NASA and U.S. policies with Russian aeronautical and space communities, directing activities associated with bilateral and multilateral agreements with Russia, and analyzing and reporting on Russian national aeronautics and space programs. Candidacy requirements include:

- experience in applying U.S. foreign policy objectives, practices and principles to the planning and execution of scientific and technological programs;
- experience in establishing and maintaining liaison with international public and private sector organizations for the purpose of assuring understanding of program objectives and content;
- Russian language proficiency;
- ability to work effectively with senior officials in the Department of State and other U.S. foreign agencies; and
- knowledge of research and development of high technology programs.

1.2.6 Differences between the Role of the NASA Russian Representative and NASA European Representative

In reviewing NASA's NMLO operations it should be noted that the NASA Russian Representative (NMLO manager) position was modeled after that of the current NASA European Representative. Although both positions include high level NASA policy responsibilities, the role of the NASA Russian Representative includes wide ranging administrative, budgetary, and Embassy-related responsibilities not included in the role of the NASA European Representative.

The NASA Russian Representative/NMLO manager heads the only NASA overseas office with both a policy and technical role. He or she was envisioned to act as the coordinator for the NASA program representatives in Russia; the European Representative, on the other hand, requires no program co-location or technical liaison duties.

NASA activities in Russia involve a high level of administrative overhead and involvement by the NMLO. As a result, the NASA Russian Representative has extensive day-to-day budgetary responsibility for processing funding through the Embassy, not only for the NMLO itself, but for all the NASA organizations expending funds in order to buy goods and services in Russia. The NASA European Representative has no budget to administer, or comparable budgetary responsibilities relative to NASA organizations operating in Europe. The NASA Russian Representative has a variety of administrative and fiscal responsibilities in addition to his or her policy and liaison role. The NMLO provides services to an unprecedented number of NASA travelers to Russia, including invitations required for the visa process, and special arrangements for lodging.

The NASA Russian Representative represents in-country NASA personnel on the Embassy team, and as such, has high visibility in the Moscow Embassy. The Ambassador has a keen interest in NASA activities due, in part, to the close working relationship with the Embassy's Environmental, Science and Technology Counselor. In contrast, the NASA European Representative is not located in an American Embassy; therefore, he or she has no direct relationship with the Ambassador that must be constantly and carefully maintained in order to carry out his or her daily responsibilities.

1.2.7 Placement of Civil Servants in Russian Space Organizations

As previously mentioned, the Ambassador was initially opposed to placing civil servants in Russian organizations. When NASA was originally looking for commercial space in Moscow, the Ambassador made it clear that NASA personnel must be located on the Embassy compound. However, after its first year in Moscow, the Ambassador has become more accepting of NASA's ideas for placing persons outside of the Embassy.

1.2.8 NASA Budget Operations in Russia

The NMLO budget is funded through NASA Institutional and Program funding. The State Department and the U.S. Embassy are involved in disbursement of all NASA funds to be spent locally in Moscow. Cables between NASA and State Department/U.S. Embassy are required in order to authorize expenditure payment via Embassy. Because of the need to process funding through the Embassy, the NASA NMLO office is the central point of contact for all NASA organizations with requirements for expending funds to purchase goods and services in Russia. The NASA organizations spending funds in Russia include: Space Station Program Office - MTLO; Johnson Space Center - Shuttle/Mir GCTC Operations; Code I - NMLO; and Code O - PSCN. The astronauts and life sciences personnel assigned to the GCTC receive their paychecks through the Embassy. NASA personnel in the GCTC receive administrative services including assistance with customs and visas from the NMLO at the Embassy.

Although the MTLO was established by, and receives its funding from, the Space Station Program Office, other NASA organizations have been using MTLO resources at an increasingly frequent rate, particularly for administrative support such as transportation and accommodation arrangements. While other NASA program codes use MTLO services, however, they do not contribute funding for these services.

2. PRIMARY OBSERVATIONS - NMLO/MTLO OPERATIONS

Since the establishment of a NASA presence in Russia, the efforts of the staff of the NMLO and the MTLO have been outstanding. The same applies to the individuals assigned to the GCTC and the Mission Control Center - Moscow. NASA's presence in Russia to date has been successful, partly because the NASA personnel assigned to Russia have overcome numerous obstacles to establish their respective programs and have proven very effective in working with their Russian counterparts. The NMLO/MTLO staff has also established an excellent working relationship with the Embassy. In fact, every Embassy official with whom the Task Force members met praised the efforts and the professionalism of the NASA team in Russia.

The NMLO/MTLO team, however, has been operating under significant handicaps which greatly impede their ability to meet their objectives and to support Russian participation in Phase 1, International Space Station Alpha (ISSA) development, and other NASA activities. These handicaps also impact NASA's relationship with the Embassy and the Russians.

The most serious handicap is the absence of a single NASA official with overall responsibility for the NASA presence in Russia. As explained in the previous section, these responsibilities are currently shared by the NMLO manager and the MTLO manager. The lack of a single NASA official in charge in Russia has caused the Ambassador and the Embassy considerable frustration and concern. The Task Force members were told during the meetings in Russia that NASA is the only Government agency operating at the Embassy without a clearly identified lead individual. This is a very serious issue given the critical nature of NASA's relationship with the Ambassador and the Embassy staff. The Russians also have been confused by the lack of a single NASA official representing the Agency in Russia. To date, there have been no serious problems; however, it has placed a burden on the Embassy Environment, Science, and Technology Counselor who currently handles a number of political/diplomatic areas for NASA, and who, on behalf of the Ambassador, has responsibility for NASA affairs at the Embassy.

To date, NASA has benefited from the support of Ambassador Pickering and his staff. The point has been reached, however, where the Embassy expects that NASA will identify a

single individual who will bear overall responsibility for NASA's presence in Russia, and who will be able to integrate into the Embassy's country team and to support it fully. If NASA does not meet these expectations quickly, it may jeopardize its relationship with the U.S. Embassy in Moscow, a relationship which is important to the success of U.S./Russian cooperation in space.

In defining the role of the NASA Representative in Russia, the Agency must recognize that senior Russian officials and the U.S. Ambassador expect the Representative to be a senior-level envoy for the NASA Administrator who speaks with a single, credible voice for the Agency. The U.S. Ambassador sees the Representative as responsible for the actions of all NASA civil servants and contractors in Russia. That is not to imply that the Representative is expected to control the technical content of the interactions between NASA organizations and their Russian counterparts. The Ambassador, however, expects the Representative to be well informed on the status of interactions between NASA and its Russian counterparts as well as potential issues and problems. In the same vein, several Embassy officials stated quite clearly that, to be effective, the NASA Representative must have the authority to remove from Russia any NASA civil servant or NASA-directed contractor employee whose conduct, in his or her determination, is not in the best interests of the Agency or is outside the bounds of the individual's specific charter.

Currently important opportunities with the Russians may well not been recognized or pursued due to the lack of a single, authoritative NASA representative in Moscow. More importantly, numerous possibilities for serious miscommunication exist as a result of the current structure. Finally, although no major stumbling block has appeared in the course of NASA's activities in Russia which would have required the quick reaction of the Representative, it would be a mistake to assume that such an event will not occur. The absence of a single individual who represents the Administrator, can speak for the Agency, and who is credible to senior Russian officials seriously hampers effective interaction between NASA and senior officials of the Russian Government and aerospace sector.

In the Task Force's opinion, the current level of interaction between NASA organizations and their Russian counterparts will not remain static. The past several years have witnessed a widening and deepening of those relationships. This trend will continue as ISSA moves into development and implementation, and other cooperative activities (e.g., Mission to Planet Earth, planetary exploration, aeronautics, etc.) are initiated. The continued absence of a single NASA point of contact for this deepening, widening relationship may seriously impede progress, result in missed opportunities and expose the agency to a higher level of risk.

As of the publication of this report, NASA is in the process of selecting an individual to be the NASA Representative in Russia. However, it is the opinion of the Task Force, that the

roles, responsibilities and authority of that position, as advertised, do not reflect the broad authority which is required given the broad scope and range of NASA activities currently underway in and with Russia. NASA should consider an expanded role for the NASA Representative in Russia.

Finally, the Task Force notes that the absence of a written charter for the NASA Representative, subscribed to by the NASA Administrator and senior NASA management, will significantly hamper the Representative's effectiveness. No such charter currently exists, and the Task Force is unaware of any effort within NASA to develop one. Without a clearly defined charter, the NASA Representative will have a difficult time establishing the roles, responsibilities, and authority of this critical position as well as rapidly developing the necessary relationships with senior Russian officials.

2.1 Primary Recommendations

Recommendation: 3-2.1.1

Develop written guidelines to enable the NASA Representative in Russia, once selected, to build a credible charter. To be most effective, the charter should clearly state that the NASA Representative in Russia:

- Speaks for the Administrator on behalf of all NASA elements operating in Russia.
- Has direct access to the NASA Administrator.
- Advises the NASA Administrator and senior NASA officials on U.S. foreign policy objectives and Russian space developments as they affect NASA program activities.
- Assures that the initiation, formulation, coordination, negotiation, implementation, and monitoring of bilateral and multilateral agreements with Russia are consistent with U.S. foreign policy and NASA project/program guidance.
- Coordinates through the NASA Office of External Relations (Code I) for management of administrative and support functions in Russia.
- Has the authority to remove from Russia any NASA civil servant or NASA contractor who exceeds the charter of his or her respective organization or who jeopardizes the Agency through his or her actions.

Recommendation 3-2.1.2:

Complete the selection process for a NASA Representative in Russia with expanded responsibilities as soon as possible.

3. ADDITIONAL OBSERVATIONS - NASA ORGANIZATIONS OPERATING IN RUSSIA

3.1 Background

None of the NASA organizations currently operating in Russia has developed a charter which clearly describes the scope of its activities, objectives and the roles of civil servants or contractor personnel working in, or traveling to Russia. In addition, there is limited coordination between all of the disparate NASA elements operating in Russia. And at this point, there is no NASA Headquarters oversight over the activities of the various NASA organizations' activities.

Not only is this approach inefficient, it also exposes NASA to a higher level of risk of confusing or contradictory messages being given to Russian officials and organizations. With a number of NASA organizations operating independently in Russia, the possibility that confusing or contradictory messages will be given to Russian officials and organizations is significantly greater than it would be if the NASA Representative was kept abreast of the objectives and activities of NASA organizations operating in Russia.

Another area of consideration is the long-term staffing of NASA activities in Russia. NASA management should recognize the unique challenges NASA civil servants face living and working in Russia given the existing cultural and language barriers and living conditions which differ markedly from those in the U.S. For this reason, NASA's should evaluate its requirements and processes for recruiting, preparing and retaining well-qualified civil servants to serve in Russia.

3.2 Additional Recommendations - NASA Organizations Operating in Russia

Recommendation 3-3.2.1:

Each NASA organization operating in Russia must provide a charter for its activities to the NASA Representative in Russia. This charter must clearly spell out the scope of the organization's activities and the roles of any civil servants or contractors working in or traveling to Russia.

Recommendation 3-3.2.2:

Each NASA organization operating in Russia must coordinate with, and provide regular status reports to, the NMLO regarding its activities in Russia.

Recommendation 3-3.2.3:

Each NASA organization operating in Russia should develop a plan to:

- actively recruit qualified candidates;
- offer the benefits (e.g., housing, home leave, differential pay, etc.) necessary to attract qualified candidates;
- carefully screen candidates;
- provide a career development path for each individual who chooses to serve;
- ensure adequate language and cultural training (the National Foreign Affairs Training Center 44-week course is highly recommended by the Department of State and the Department of Defense); and
- develop a pool of qualified and prepared candidates available to serve in Russia.

3.3 Additional Observations - NMLO Budget and Budget Support

As discussed previously, both the NMLO and the MTLO have been providing support not just for Phase 1 and Space Station operations, but for other NASA activities in Russia as well. A far more equitable arrangement and more efficient and cost-effective approach would be to create a single budget covering the administrative operations of the NMLO/MTLO and administrative support to other NASA entities operating in Russia.

The current system for funding services is very inefficient. Individual vouchers are prepared for almost any item or service required while funding must be transferred to the Embassy for each expenditure. Given the detailed accounting provided by the Embassy system, a more efficient approach would be to provide to the Embassy lump sum amounts which could be used as needed with each expenditure tied to the NASA organization requiring the goods or services. Such an approach would be far more effective than the current one and would provide NASA with a detailed accounting of support costs in Russia as well as an accurate method for developing budget projections.

The managers and staff of the NMLO/MTLO made a number of specific suggestions for improving the way they do business. One specific example was to use direct-hire Russian employees rather than contract employees. According to their analysis, such an approach significantly reduces costs, avoids Embassy restrictions and provides for better management. Another suggestion was to establish a NMLO/MTLO travel budget under the direct control of the office. These options, as well as several other possible areas of cost savings, were suggested to the Task Force; however, at this time the Task Force members have not conducted an in-depth review of these options.

To explore these and other options for improving the efficiency and cost-effectiveness of the NMLO/MTLO office, NASA should assign a budget and finance expert at Headquarters to work directly with the office. This individual should have the authority to establish policy and procedures in this area with a minimum amount of review and approval.

3.4 Additional Recommendations - NMLO Budget and Budget Support

Recommendation 3-3.4.1:

NASA should develop a comprehensive financial plan for NMLO operations and administrative support. NASA should also assign a budget expert at NASA Headquarters to support the NMLO/MTLO operation. This individual should have the authority to expedite solutions to the unique challenges facing that operation.

Each NASA organization operating in Russia should be required to:

- clearly spell out, in a written charter, the scope of its activities in Russia and the roles of any civil servants or contractors working in or traveling to Russia;
- coordinate with and regularly status the NMLO on its activities in Russia;
- allocate resources to the NMLO to cover administrative services.

3.5 Placing Civil Servants in Russian Space Organizations

As discussed previously, the Ambassador was initially opposed to placing NASA civil servants in Russian space organizations; however, he has become more accepting of this concept over time. As a result, NASA is beginning to be able to place personnel outside the Embassy in Russian technical organizations.

An excellent example of the advantages of such placements for NASA was the assignment of a NASA/JSC engineer as the Docking Mechanism Integrated Product Team

representative at RSC-Energia. In November 1994, Mr. Randy Brinkley, Manager, Space Station Program Office (SSPO) at JSC requested that the NMLO/MTLO make arrangements to assign a NASA docking specialist who would be located at the RSC-Energia facility. With the approval of NASA and RSC-Energia, this employee was assigned as the technical representative to the Russians for design, manufacture and testing of docking hardware. Administratively this employee reports to the MTLO manager at the Embassy, but takes technical direction from the Engineering Directorate at JSC. He coordinates with JSC and contractor personnel to resolve technical issues related to the docking mechanism systems and hardware. Initially, this concept met resistance within NASA, but it has proved invaluable. There is no substitute for personal interaction and on-site presence, especially when there are technical interface requirements to meet. Given the cultural and language barriers involved in doing business in Russia, on site placement is definitely more effective in building working relationships than videoconferencing and teleconferencing. It is the Task Force's opinion that NASA should continue to pursue relocating more engineers from the U.S. Embassy compound to Russian technical organizations.

Fifth Report: Task Force on the Shuttle-Mir Rendezvous and Docking Missions

Part 4: ADP/T Review Team Report

ADP/T Team:
Shuttle-Mir Task Force Final Report

July 19, 1995

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1. ADP/T TEAM EXECUTIVE SUMMARY

1.1 Charter

On December 6, 1994, NASA Administrator, Mr. Daniel Goldin, requested that Lt. Gen. Thomas P. Stafford (Ret.),[1] in his role as the National Aeronautics and Space Administration (NASA) Advisory Council Task Force chairman on the Shuttle-Mir Rendezvous and Docking Missions, "Lead a team composed of several task force members and technical advisors to Russia to review preparations and readiness for the upcoming International Space Station Phase 1 missions."

The fourth report of the above task force activity provided an observation relative to the delays in the installation of institutional automated data processing/ telecommunications (ADP/T) equipment in Russia and a recommendation that the implementation of the ADP/T capabilities in Russia be given a high priority.[2]

On April 7, 1995, Dr. Bradford Parkinson, Chairman of the NASA Advisory Council, wrote to Lt. Gen. Thomas P. Stafford, "I would ask that you continue your activities to ... review the overall NASA and associated contractor presence in Russia ... including the communications capability among NASA and contractor sites in Russia and locations in the United States."[3]

1.2 Major Findings

Finding 1:

In the team's opinion, the processes for the collection of institutional ADP/T requirements and the implementation of those requirements are adequate and working. However, the communications capabilities between the U.S. and Russia are still limited, and the estimated installation completion for current requirements is the end of 1995, due to the following observations:

---

[1] Letter, Mr. Daniel S. Goldin, NASA Administrator, to Lt. Gen. Thomas P. Stafford, Chairman of the NASA Advisory Council Task Force on the Shuttle-Mir Rendezvous and Docking Missions, December 6, 1994 (see Appendix 1)

[2] The Fourth Report of the Task Force on the Shuttle-Mir Rendezvous and Docking Missions, March 1, 1995

[3] Letter, Dr. Bradford Parkinson to Lt. Gen. Thomas P. Stafford on the Task Force on Shuttle-Mir Rendezvous and Docking Missions, April 7, 1995 (see Appendix 2)

Observation 1:

The Joint U.S./Russian Institutional Communication Requirements Document between NASA and the Russian Space Agency (RSA) has not been agreed to and signed. The effects of the lack of a formal agreement and signatures on this document are: (1) the site(s) design and equipment acquisition are proceeding at risk and (2) the site implementation plans currently being worked cannot be finalized.

Recommendation 4-1.2.1:

The Joint Institutional Communications Requirements (JICR) Working Group and Johnson Space Center (JSC) Institutional Communications Requirements (ICR) Panel should continue current processes until the U.S./Russian JICR Document is signed. A reasonable target date for signing of the document is July 28, 1995.

Observation 2:

The site-specific implementation plans for each Russian facility/site have not been finalized due to the lack of a signed U.S./Russian JICR Document.

Recommendation 4-1.2.2:

The site-specific implementation plans should be finalized within a 6-week timeframe following RSA/NASA joint signing of the U.S./Russian JICR Document.

Observation 3:

An end-user information package (i.e., users manuals, reference guides, log-on E-mail instructions, etc.) is needed in conjunction with institutional ADP equipment/software to be utilized in Russia.

Recommendation 4-1.2.3:

PSCN should include instructions for users of institutional ADP equipment/software delivered to Russia as part of the deliverable Request For Service (RFS) packages. Training requests should be addressed on a case-by-case basis.

Observation 4:

A logistics and depot maintenance plan is needed for institutional ADP/T equipment located in Russia.

Recommendation 4-1.2.4:

Prior to implementation completion, a logistics and depot maintenance plan should be developed. From this plan, a funding profile should be developed.

Observation 5:

A property control/inventory system for equipment located in Russian and U.S. facilities is needed.

Recommendation 4-1.2.5:

A property control/inventory system should be developed for all equipment located in Russian and U.S. facilities, including portable ADP equipment located at the Moscow Technical Liaison Office (MTLO).

Observation 6:

There is currently no contract to provide ADP support in Russia. A Request for Proposal (RFP) has been released for the selection of a contractor to provide ADP support in Russia, and it is expected that the contract will be awarded by mid-September 1995.

Finding 2:

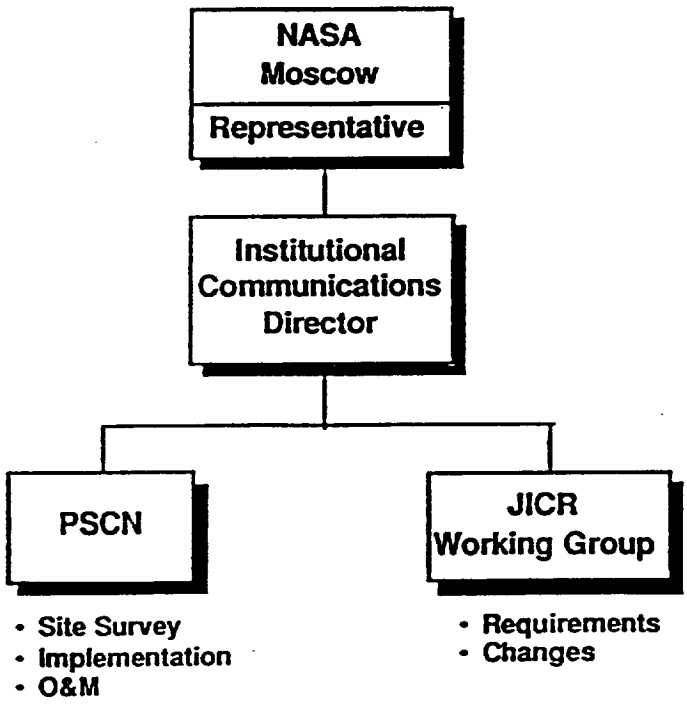
There is no single identifiable manager responsible for the total process for installation and operations and maintenance (O&M) of the institutional ADP/T infrastructure in Russia.

Recommendation 4-1.2.6:

The focal point of this activity will be in Russia; therefore, an Institutional Communications Director position should be established in Russia with the following major tasks:

- Report directly to the NASA Moscow Senior Representative;
- Responsible for the oversight of implementation of the site-specific plans;
- Act as Contracting Officer's Technical Representative for O&M contracts;
- Approve all changes to the signed NASA/Russian JICR Document;
- Responsible for budget controls; and
- Coordinate Russian activities with MSFC management.

Proposed Organization



1.3 Basis for Confidence

The major finding that the processes in place to provide institutional ADP/T services to NASA personnel in Russia are adequate and working is based on data reviews, interviews, discussions, and interactive working sessions conducted by the Review Team in the United States and a teleconference held with NASA personnel in Russia. Figure 1 provides an overview of the Russian locations.

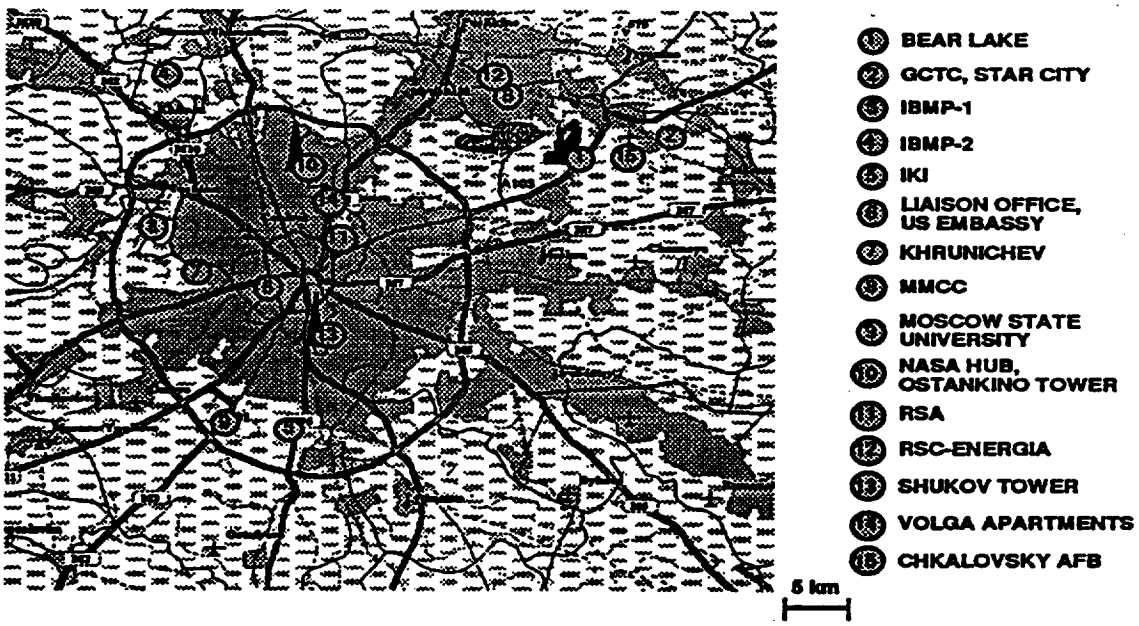


Figure 1. Current Activities - Russian Project

Previous NASA work with the Russians on telecommunications that has served as a pathfinder includes:

a. In 1993, interim service was installed by Program Support Communications Network (PSCN) to:

- Russian Institute of Space (RSC-Energia)
- Institute for Biomedical Problems (IBMP)
- Institute of Space Research (IKI)

b. In 1993, PSCN submitted design goals and concepts to provide long-term support for telecommunications requirements in Russia, including the following:

- RSC-Energia
- IKI
- IBMP
- Gagarin Cosmonaut Training Center, Star City (GCTC)
- RSA
- Mir Mission Control Center (MMCC)
- Mytishchi
- Khrunichev
- NASA Moscow Technical Liaison Office (MTLO)

c. In 1994, a communications contract was awarded to IDB, Worldcom by Computer Sciences Corporation (CSC) under contract to Marshall Space Flight Center (MSFC) PSCN for installation, operations and maintenance for the Ostankino Hub, tail circuits to end user's locations, and O&M of end user's equipment.

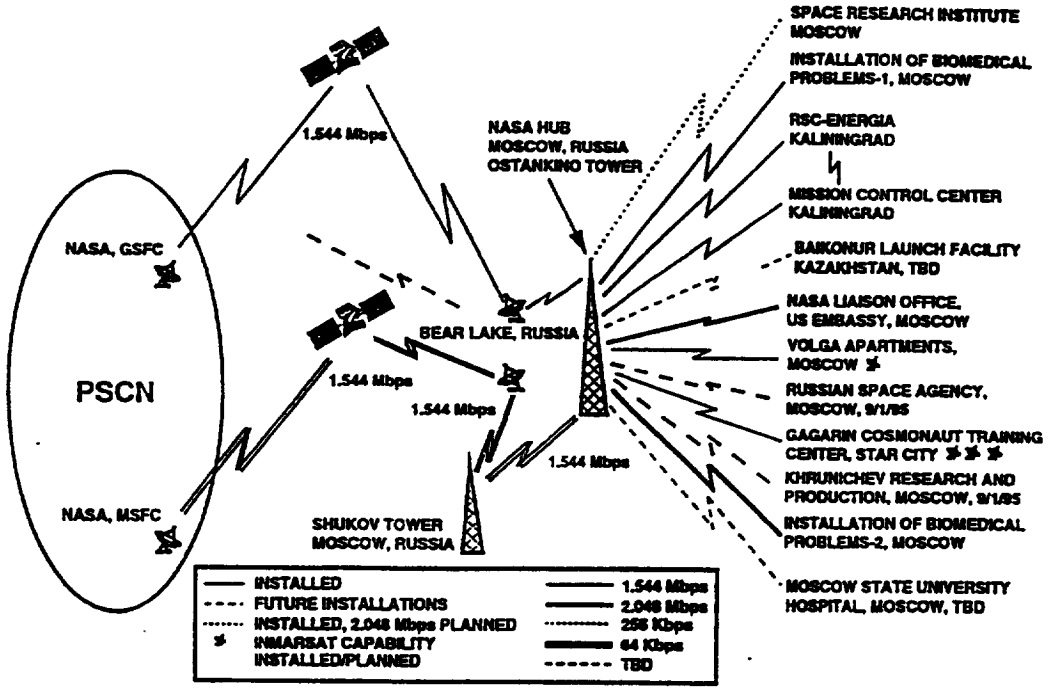


Figure 2. Russian Infrastructure Plan: Current Status

The current status of the communications circuits in Russia from Ostankino Hub is shown in Figure 2.

PSCN has been providing telecommunication services to NASA for several years and has an excellent record of managing and providing support to NASA programs requiring international telecommunications. Russia is the first international partner to allow NASA to coordinate the installation of circuits/services in-country.

As a result of discussions with and one-on-one direct interactions with the personnel involved in the Russian ADP/T project, as well as the end users of the ADP/T services, the Review Team concluded that professional, technically competent people are in place throughout the Russian ADP/T project. In addition, strong working relationships between Russian and U.S. counterparts have developed and are continuing to mature. These relationships have fostered a sense of mutual trust, which is absolutely essential to the success of not just Phase 1, but to the entire International Space Station program.

The following data was provided by Mr. Kenny Mitchell, Director of the NASA Moscow Technical Liaison Office, to illustrate the traffic in E-mail between the United States and the MTLO in the first 4 months of service:

	E-MAIL OUT	E-MAIL IN	TOTAL E-MAIL
March 1995	597	1041	1638
April 1995	874	603	1477
May 1995	2500	1900	4400
June 1995	3866	3091	6977

1.4 Future Activity

The ADP/T Review Team believes the following activities are required to complete this task:

a. Temporarily disband the ADP/T Review Team;
b. Assign to MSFC a 6-month task to provide continuity (one person);
c. Reconvene the Review Team in October 1995 time frame in conjunction with the STS-74 Task Force Review to assess:
   - Status of JICR Document and site implementation plans;
   - Status of operations and maintenance for telecommunications and ADP equipment in Russia;
d. Visit specific Russian sites as part of the STS-74 Task Force visit to Russia; and
e. Generate a delta report.

2. INTRODUCTION

2.1 Background

In May 1994, the Task Force on the Shuttle-Mir Rendezvous and Docking Missions was established by the NASA Advisory Council. Its purpose is to review Phase 1 (Shuttle-Mir) planning, training, operations, rendezvous and docking, and management and to provide interim reports containing specific recommendations to the Advisory Council.

On December 6, 1994, NASA Administrator, Mr. Daniel Goldin, requested that Lt. Gen. Thomas P. Stafford, as the NASA Advisory Council Task Force Chairman on the Shuttle-Mir Rendezvous and Docking Missions, "lead a team composed of several Task Force members and technical advisors to Russia to review preparations and readiness for the upcoming International Space Station Phase 1".[4]

The fourth report of this Task Force activity provided an observation relative to the rudimentary NASA ADP/T infrastructure in Russia and the delays in the installation of these capabilities. The report further recommended that NASA give the implementation of these institutional ADP/T capabilities in Russia a high priority.

On April 7, 1995, Dr. Bradford Parkinson, Chairman of the NASA Advisory Council, wrote to Lt. Gen. Thomas P. Stafford, " I would ask that you continue your activities to review the overall NASA and associated contractor presence in Russia ... including the communications capability among NASA and contractor sites in Russia and locations in the United States."[5]

2.2 ADP/T Review Team Charter

Based on the above background data, the following charter was developed:

Review processes for collecting, prioritizing, and documenting requirements for the automated data processing/telecommunications (ADP/T) institutional resources necessary to support Russian participation in Phase 1 and Space Station, as well as the process for implementing and supporting the capabilities necessary to satisfy those requirements.

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[4] Letter, Mr. Daniel S. Goldin, NASA Administrator, to Lt. Gen. Thomas P. Stafford, Chairman of the NASA Advisory Council Task Force on the Shuttle-Mir Rendezvous and Docking Missions, December 6, 1994

[5] Letter, Dr. Bradford Parkinson to Lt. Gen. Thomas P. Stafford on Task Force on Shuttle Rendezvous and Docking Missions, April 9, 1995

2.3 Methodology

Lt. Gen. Thomas P. Stafford assembled an Institutional ADP/T team, led by David H. Mobley, NASA's Chief Engineer, and composed of several Review Team members.[6] The ADP/T Review Team worked fulltime collecting data, conducting interviews, and performing analysis of the data and information provided.

The team reviewed (1) the requirements identification, collecting and documenting process; (2) the requirements implementation (design, acquisition, integration/testing, shipment, and site installation/testing) processes; and (3) the sustaining operations and maintenance processes. These are currently in place and designed to provide the institutional ADP/T resources to support Russian participation in the Phase 1 and the International Space Station, as well as other NASA activities in Russia.

Team members conducted considerable research obtaining and reviewing a wide range of source material (see the Source Data Book, the table of contents of which is in Appendix 6), including formal and informal documents, memorandums, letters, presentations, and publications. Also, interviews and detailed discussions were held with a wide range of individuals, including NASA and contractor managers, engineers, technicians, and technical staffs located in the United States and Russia. Discussions were conducted with the Director of the NASA Liaison Office, Mr. Kenny Mitchell, and the Director of the Astronaut Office at Star City, Mr. Mike Baker, via newly installed phone lines.

In April 1995, the ADP/T Review Team attended a JICR Working Group bi-weekly meeting at JSC which was chaired by Mr. Barry Waddell. This group's purpose is to provide a focal point for the identification, collection, approval, and documentation of the NASA and Russian Institutional ADP/T requirements for deployment in Russia. An overview briefing was also provided by Mr. Waddell which defined the purpose and scope of the JICR Working Group and JSC ICR Panel. Interviews were conducted with Ms. Marianne Campbell, the NASA PSCN representative located at JSC. Ms. Campbell provides the onsite working interface with the JICR Working Group and JSC ICR Panel and submits the Request for Service to the MSFC PSCN for implementation. The institutional ADP/T requirements are expressed on the RFS form. Also, an interview was conducted with Ms. Debbie Williams, the International Space Station sponsor on the JICR Working Group and JSC ICR Panel, and major requester of institutional ADP/T services in Russia.

[6] List of Review Team members (see Appendix 3)

In May 1995, the ADP/T Review Team met with the MSFC PSCN organization to receive an overview briefing on the implementation processes. Tours were also given of the following areas that provide direct support to these processes: (1) the MSFC Helpdesk to observe realtime activities, (2) the Network Management Center, a focal point for Russian network problem resolution, (3) the NASA Teleconferencing Center to observe realtime activities in arranging, monitoring, and conducting teleconferences, and (4) the Russian Staging Laboratory (commonly called "Little Russia") where preshipment assembly, integration, and testing of the hardware/software are performed. "Little Russia" simulates the communication links to every Russian site. Interviews were conducted with representatives from the CSC Customer Services, Engineering, and Operations organizations to obtain an understanding of their functions and interrelationships.

In the May to June 1995 timeframe, an ADP/T team member participated in nearly daily working sessions with the MSFC PSCN (CSC) engineers, managers, and technicians to identify the following processes: (1) requirements integration and traceability, (2) requirements implementation (site integrated design, integration hardware design, procurement specifications, etc.), (3) sustaining operations and maintenance,(4) service management, (5) travel preparation, (6) request for service, (7) RFS traceability, (8) schedules generation and maintenance, (9) management structures, and (10) configuration management and documentation control.

On May 31, 1995, the team was debriefed on the results of Mr. Waddell's trip to Russia to obtain agreement with the RSA on the U.S./Russian JICR Document. Also on June 2, 1995, the team was debriefed on the results of the MSFC PSCN representative's trip to Russia to conduct site surveys, to oversee the installation of the communication equipment, and for preliminary discussions on site implementation plans.

In June 1995, the team interviewed representatives from the NASA Communications (NASCOM), NASA Science Internet (NSI) and Code U/Headquarters to identify and document their processes for submitting institutional ADP/T requirements for Russia to PSCN. Also, discussions were held with IDB, Worldcom communications and support subcontractor to CSC for institutional communications equipment installation and support in the Ostankino Hub, tail circuits to Russian facilities, and O&M of this equipment. Followup meetings were held with MSFC PSCN, CSC, and I-NET personnel to clarify questions and concerns and to discuss preliminary observations and findings.

On July 19, 1995, an open meeting of the Task Force was held at JSC, and the ADP/T Review Team members presented their findings and observations, as well as this final report.[7]

[7] ADP/T Team Shuttle-Mir Task Force Final Report Presentation (see Appendix 4)

3. FINDINGS AND OBSERVATIONS

The team was provided with tremendous cooperation and candor at all locations visited. All parties, both end-item users and service providers, express confidence in the current processes and agree that the processes are coordinated and focused.

Finding 1:

Based on the above data and the Review Team assessment of this data, it is concluded that the processes for the collection of institutional ADP/T requirements and the implementation of those requirements are adequate and working. However, the institutional telecommunications capabilities between the United States and Russia are temporarily still limited, and the estimated installation completion for current requirements is the end of 1995 due to the following observations:

Observation 1:

The Joint U.S./Russian Joint Institutional Communication Requirements Document between NASA and RSA has not been agreed to and signed. The effects of a lack of formal agreement and signatures on this document are: (1) the site design and equipment acquisition are proceeding at risk and (2) the site implementation plans currently being worked cannot be finalized.

Recommendation:

The JICR Working Group and JSC ICR Panel should continue current processes until the U.S./Russian JICR Document is signed. A reasonable target date for the signing of the document is July 28, 1995.

Observation 2:

The site-specific implementations plans for each Russian facility/site have not been finalized due to the lack of a NASA/RSA joint signing of the U.S./Russian JICR Document.[8]

[8] See Appendix 5 for summary of the Site Implementation Plan. The complete plan is in the Source Data Book (see Appendix 6)

Recommendation:

The site-specific implementation plans should be finalized within a 6-week timeframe following NASA/RSA joint signing of the NASA/Russian JICR Document.

Observation 3:

An end-user information package (i.e., users manuals, reference guides, log-on E-mail instructions, etc.) is needed in conjunction with delivery of institutional ADP equipment/software to be utilized in Russia.

Recommendation:

PSCN should include instructions for users of institutional ADP equipment/software installed in Russia as part of the deliverable RFS packages. Training requests should be addressed on a case-by-case basis.

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Recommendation:

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Recommendation:

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Recommendation:

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- Act as Contracting Officer's Technical Representative for O&M contracts;
- Approve all changes to the signed JICR Document;
- Responsible for budget controls; and
- Coordinate Russian activities with MSFC management.

4. PROCESSES

4.1 Process Overview

The following charts depict a simplified end-to-end flow that has been subdivided into three major activities: (1) requirements, (2) implementation, and (3) sustaining operations and maintenance (see Figure 3). Figure 4 identifies the major parties and organizations involved in these processes.

4.2 Detail End-to-End Process Flows

Figures 5 and 6 provide a detailed end-to-end flow of the process. Subsequent charts will further define the process steps.

5.0 PEOPLE

As in any process, it is the people that make it work. The Review Team has gathered data, held discussions, and interviewed the personnel to understand the process. The team has also been evaluating the personnel. It is the unanimous opinion of this team that the personnel involved in deploying the institutional ADP/T equipment, software, and infrastructure are highly competent, motivated professionals dedicated to accomplishing their task.

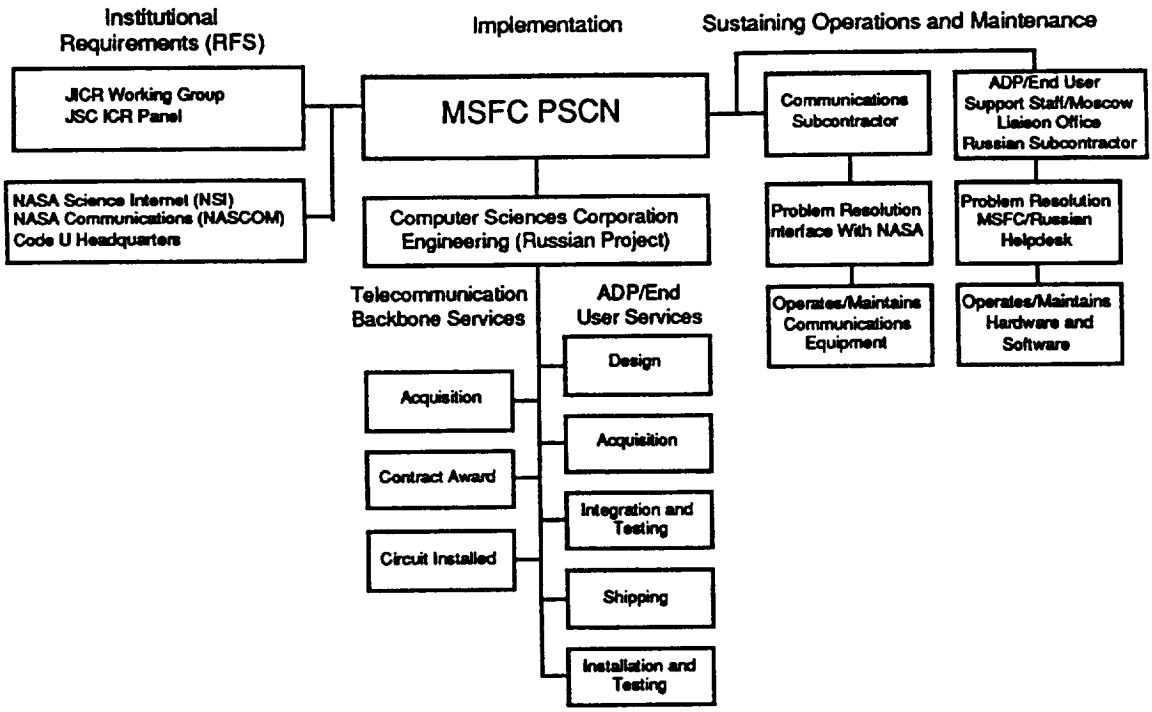


Figure 3. Process Overview

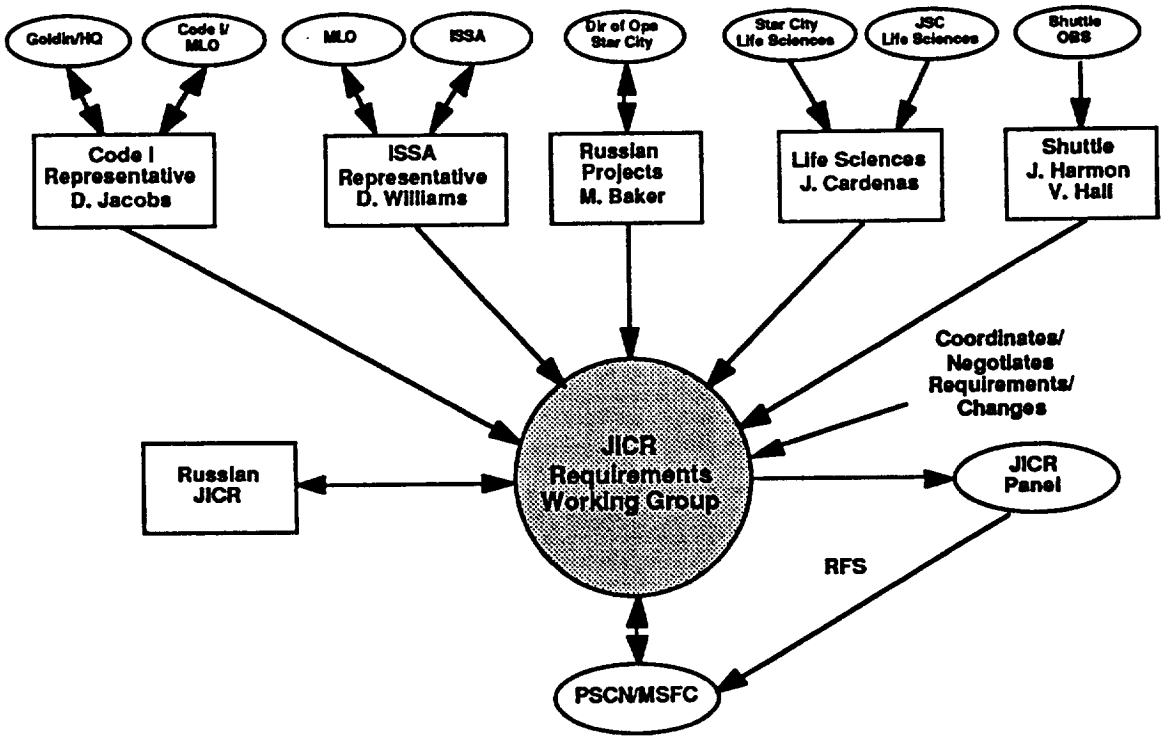


Figure 4. Parties Involved in Process

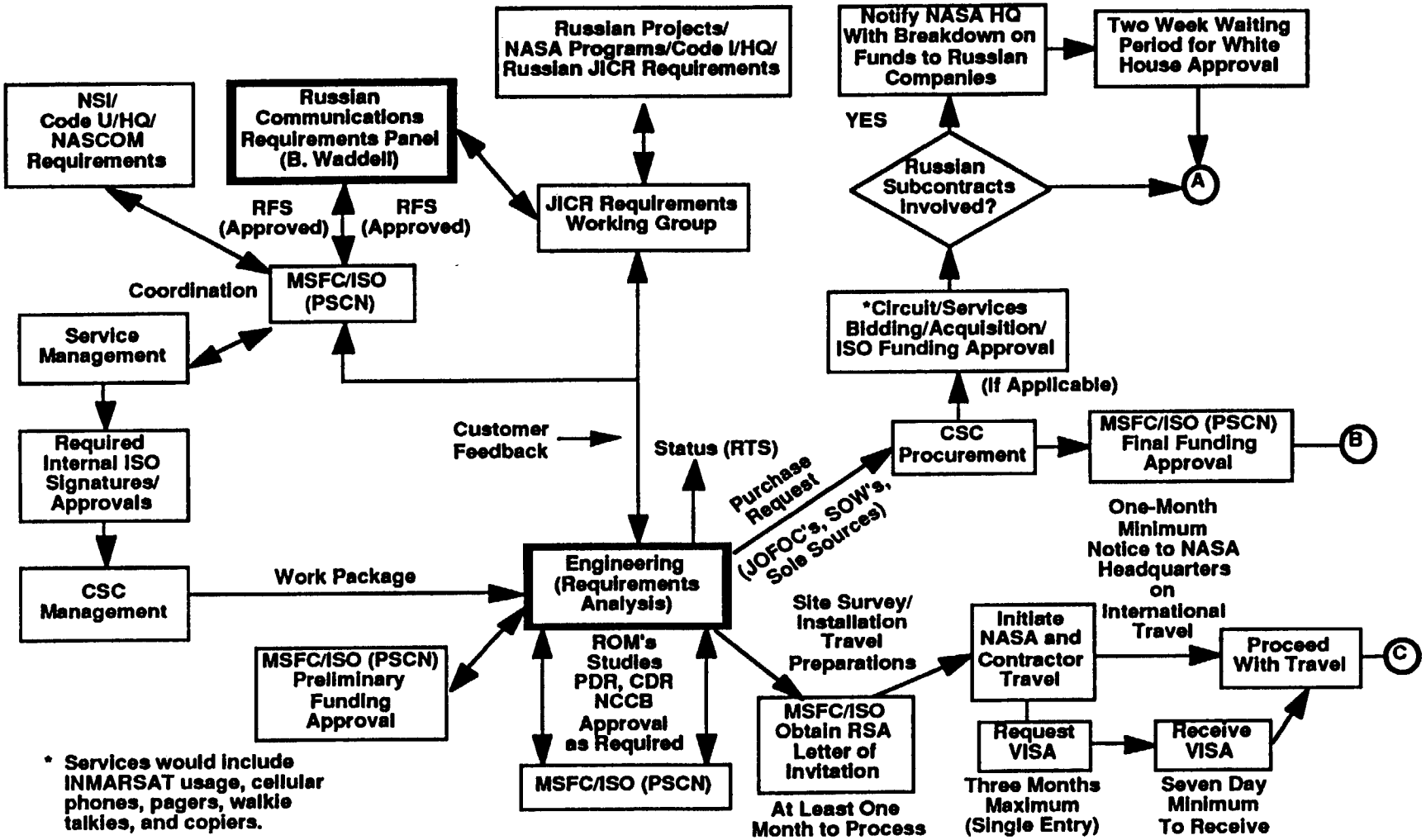


Figure 5. PSCN Russian Requirements Implementation Workflow

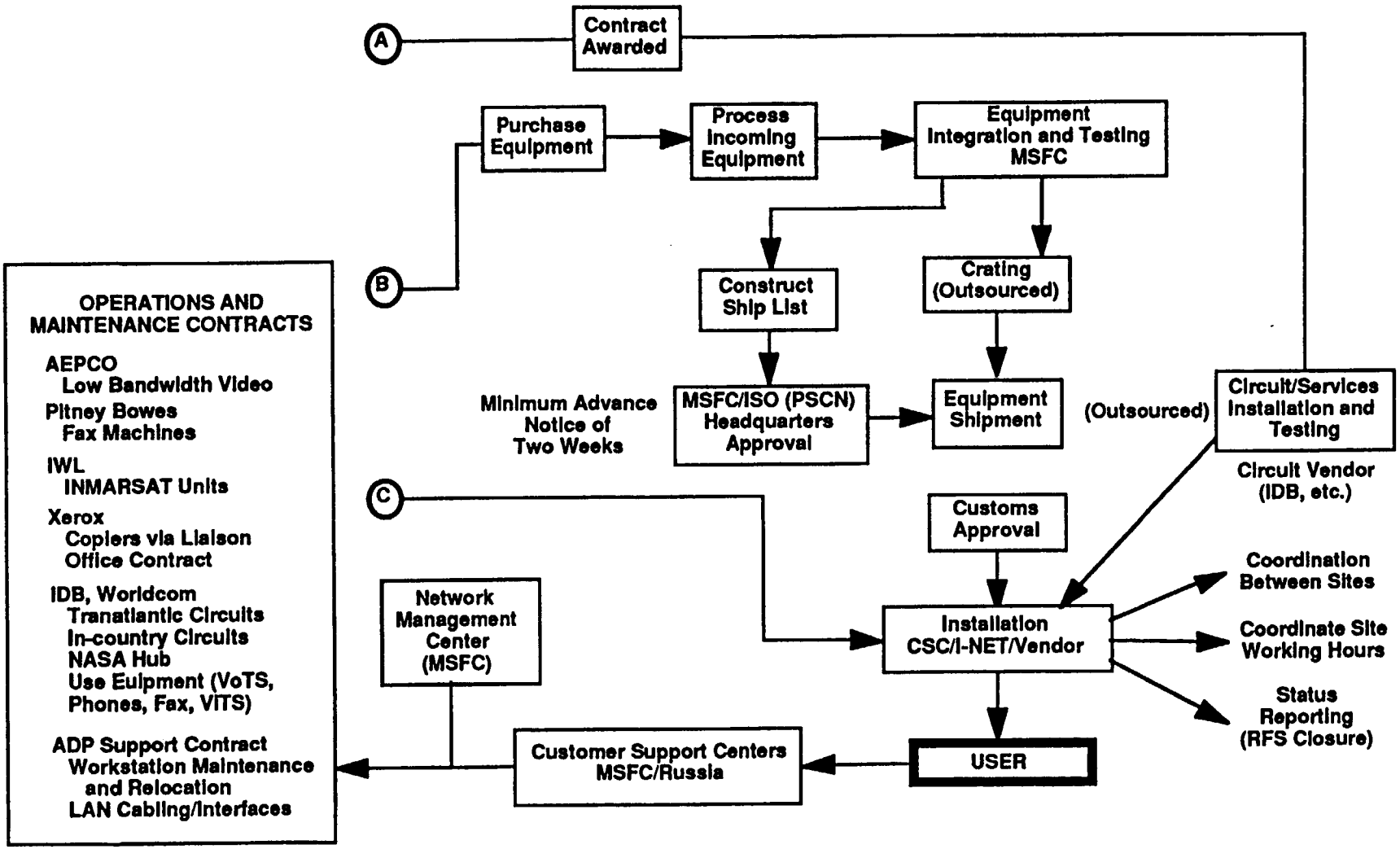
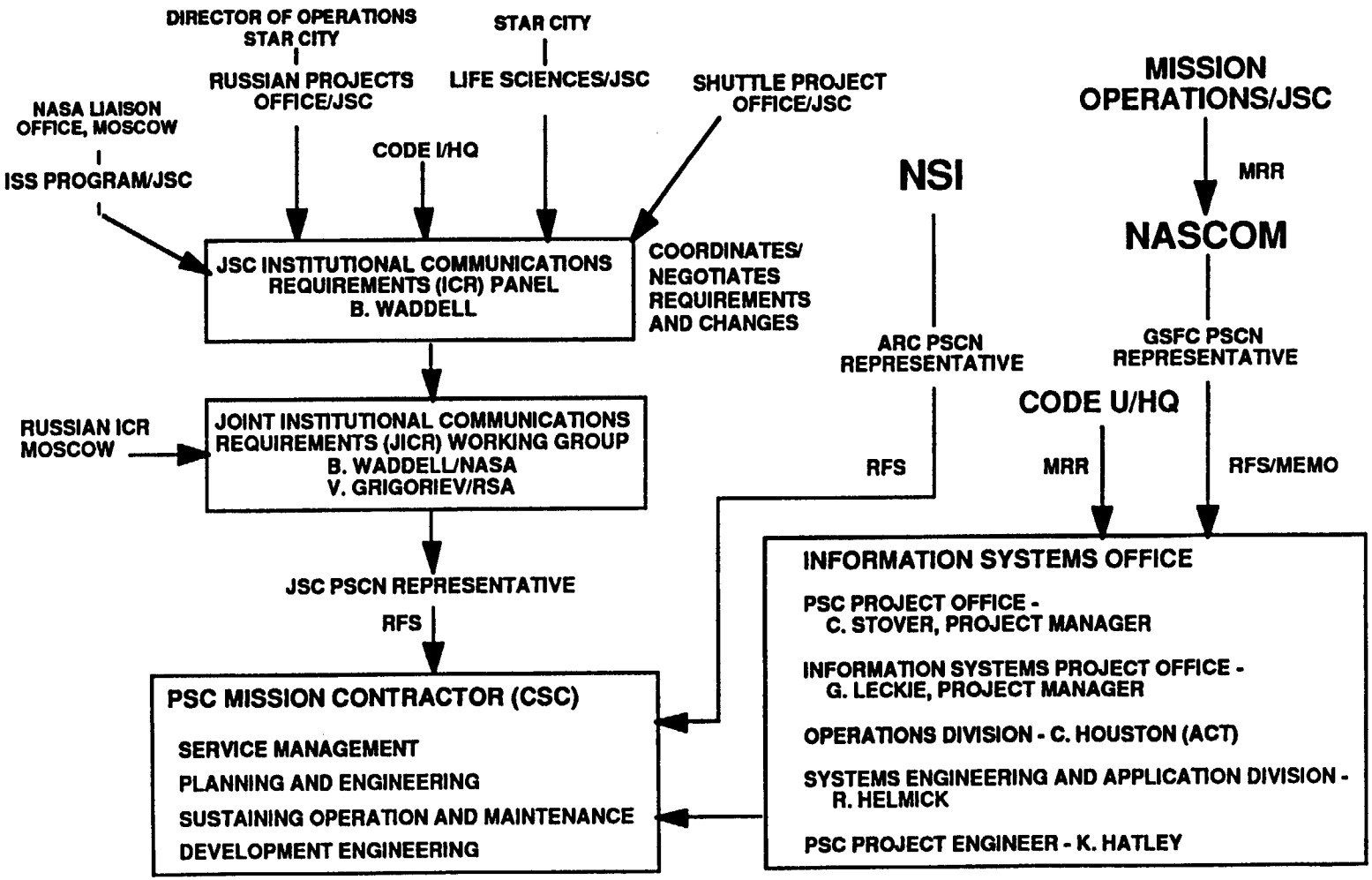


Figure 6. PSCN Russian Requirements Implementation Workflow (continued)

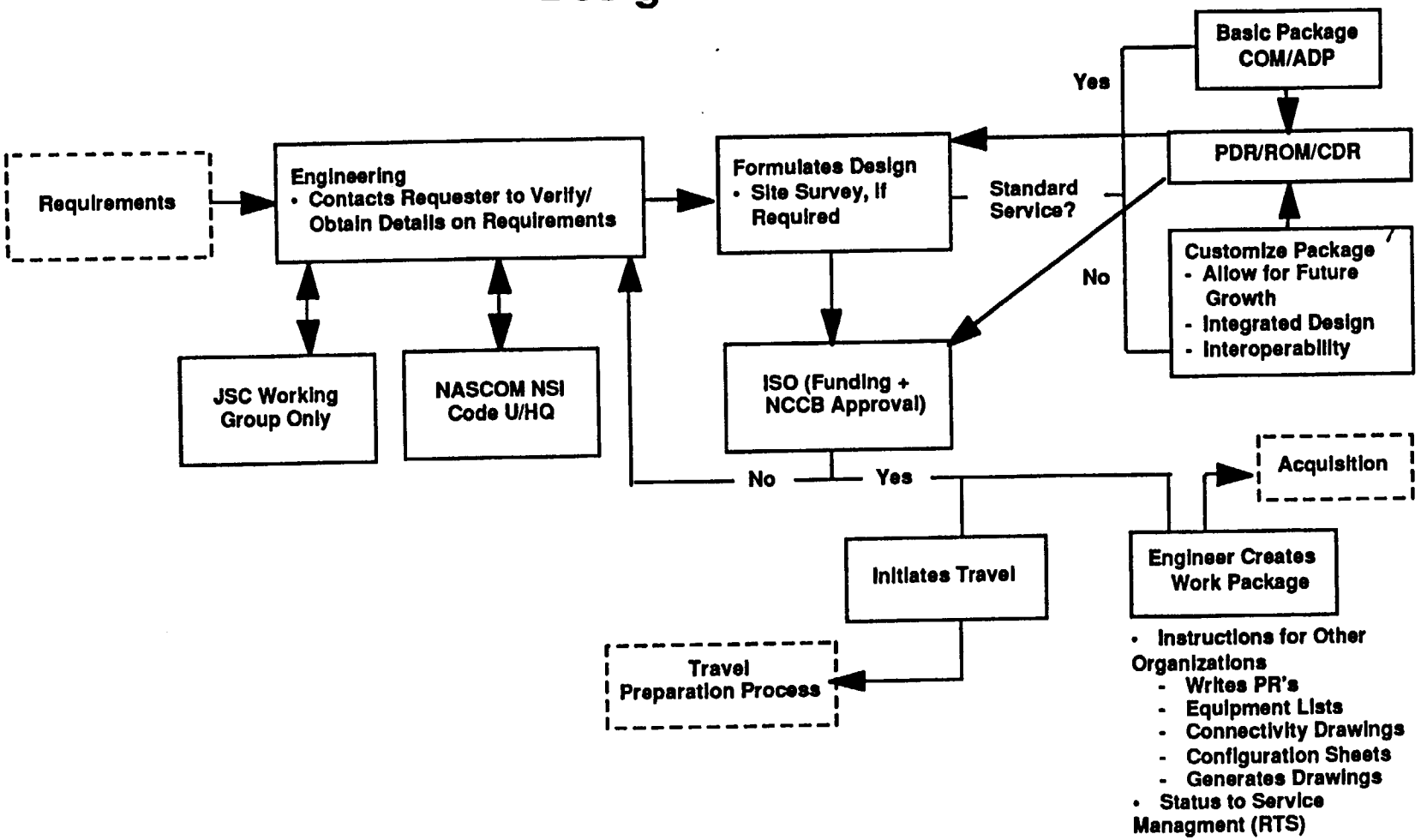
Requirements

Russian Requirements Flow



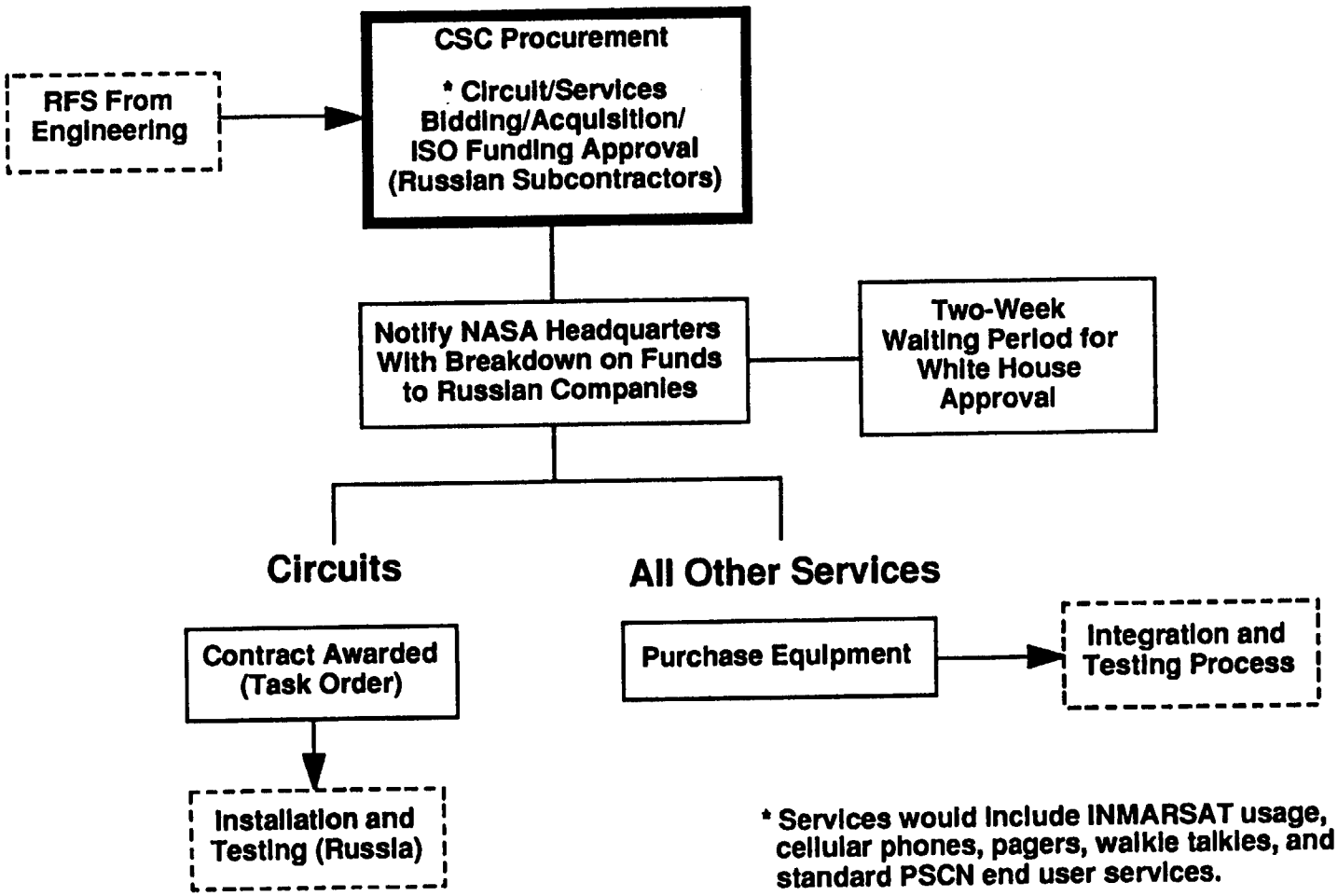
Implementation

Design Process



Implementation

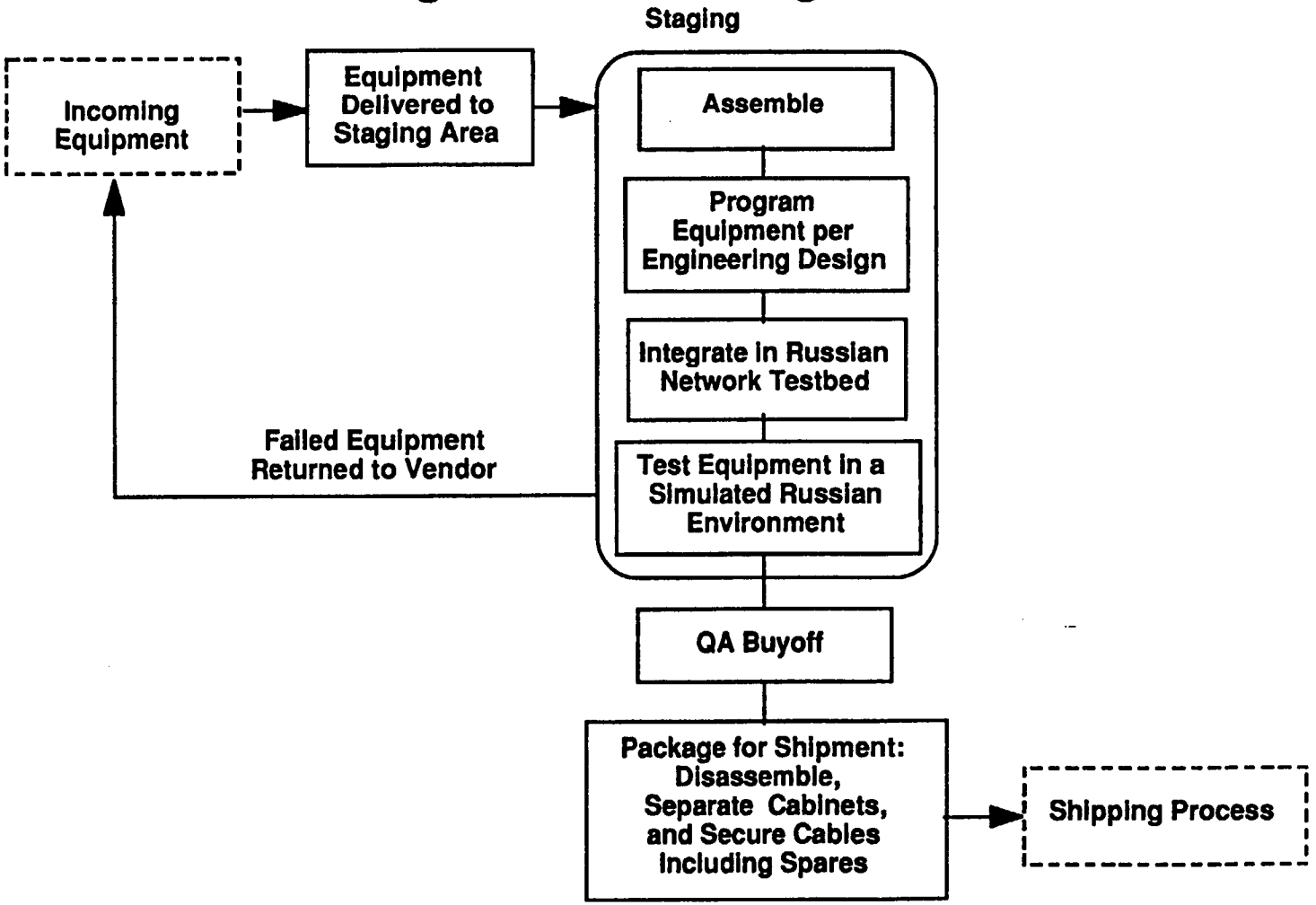
Acquisition Process



* Services would include INMARSAT usage, cellular phones, pagers, walkie talkies, and standard PSCN end user services.

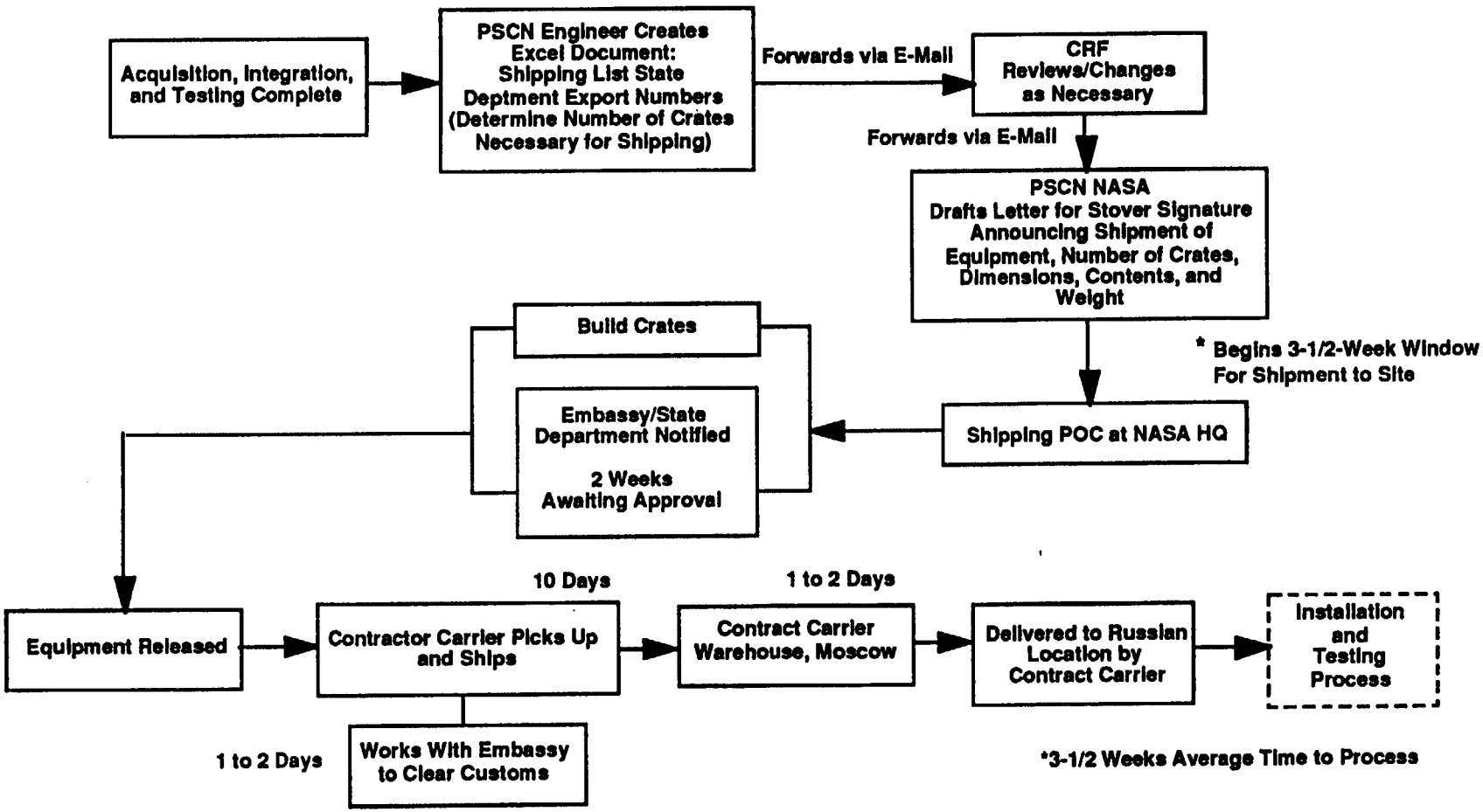
Implementation

Integration and Testing Process



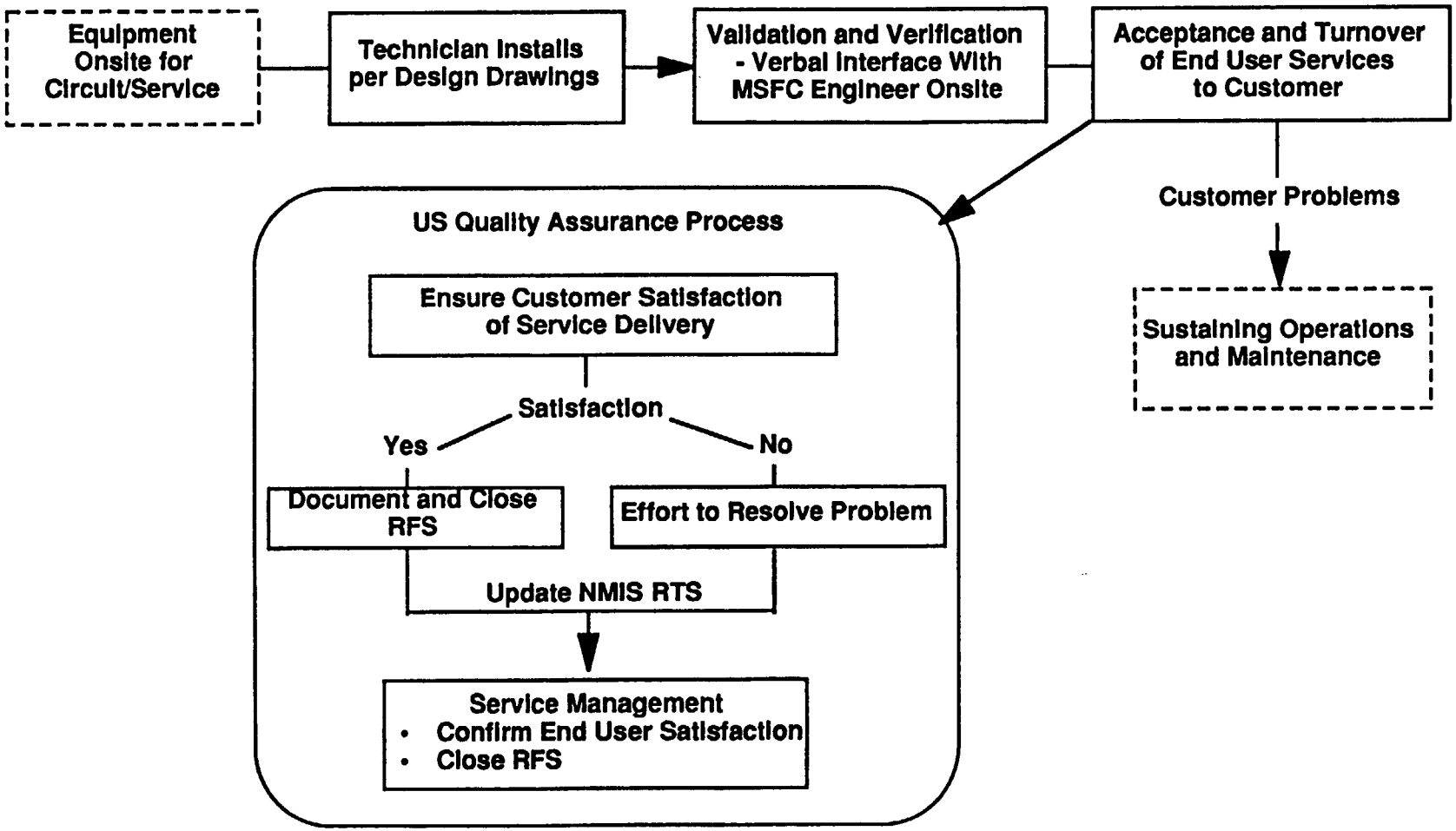
Implementation

Shipping Process



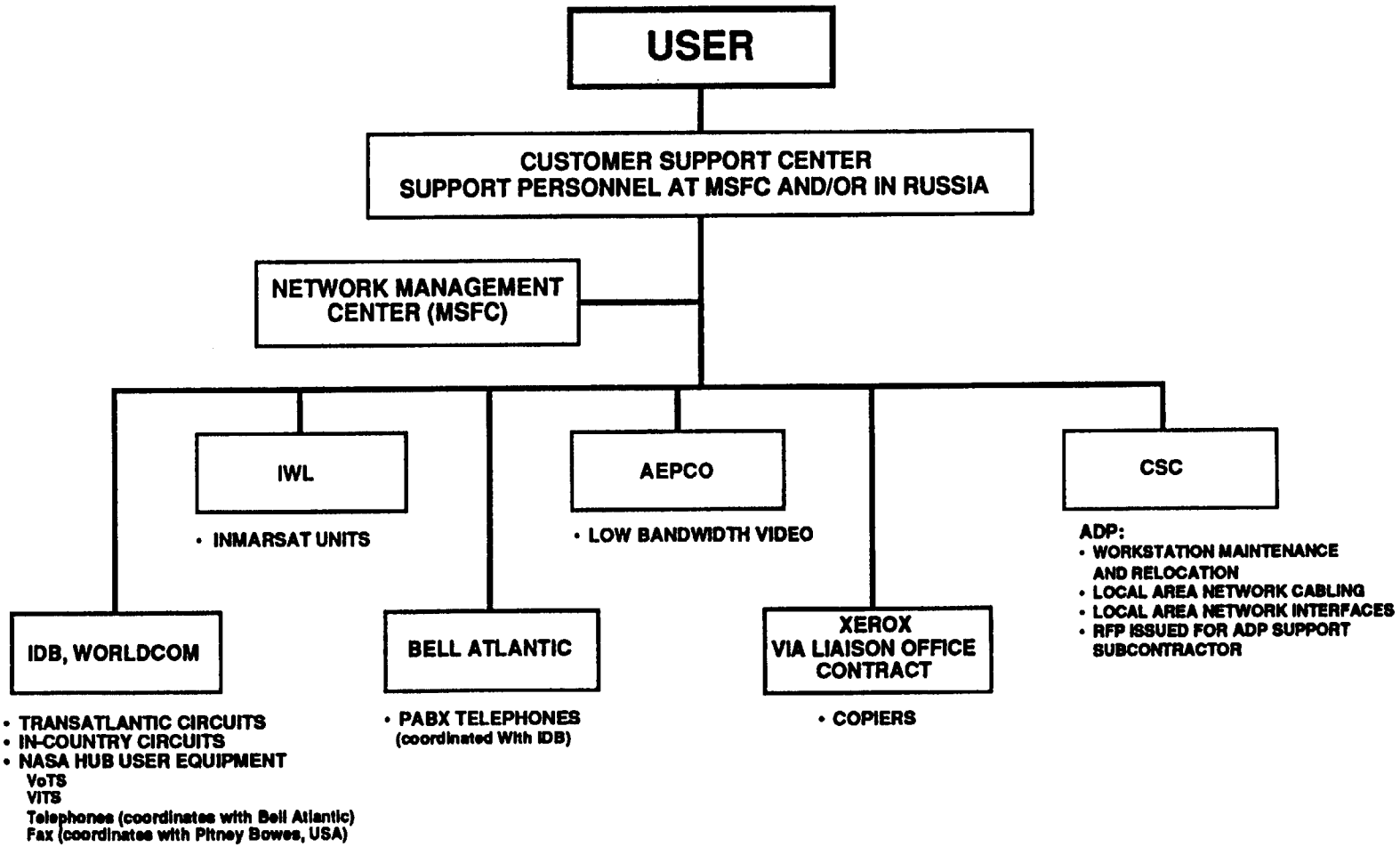
Implementation

Installation and Testing Process (Russia)



Sustaining Operations and Maintenance

Russian Operations and Maintenance Support Interfaces



Appendix 1

Letter, Mr. Daniel S. Goldin to Lt. Gen. Thomas P. Stafford, December 6, 1994

National Aeronautics and
Space Administration
Office of the Administrator
Washington, DC 20546-0001

DEC 6 1994

Lieutenant General Thomas P. Stafford, USAF (Ret.)
Stafford, Burke and Hecker, Inc.
1006 Cameron Street
Alexandria, VA 22314

Dear Gen. Stafford:

I am requesting that, in your role as Chair of the NASA Advisory Council Task Force on the Shuttle-Mir Rendezvous and Docking Missions, you lead a team composed of several Task Force members and technical advisors to Russia to review preparations and readiness for the upcoming international Space Station Phase 1 missions. Given the outstanding work the Task Force has produced to date, as well as your personal rapport with members of the Russian Space Program, I believe that a team led by you will provide NASA with an additional level of confidence.

I would like to receive your report prior to March 1, 1995. Please accept my gratitude for the valuable work you and your team have already done and for assisting NASA further in this critical effort. If I can be of any assistance, please do not hesitate to contact me.

Sincerely,

Daniel S. Goldin
Administrator

Appendix 2

Letter, Dr. Bradford Parkinson to Lt. Gen. Thomas P. Stafford, April 7, 1995

NASA Advisory Council

National Aeronautics and Space Administration
Washington, DC 20546

Chair: Bradford W. Parkinson
Professor of Aeronautics and Astronautics
Stanford University

Bobby R. Alford
Executive Vice President and
Dean of Medicine
Baylor College of Medicine

Claude R. Canizares
Director, Center for Space Research
Massachusetts Institute of Technology

John R. Dailey
Acting Deputy Administrator
NASA

LeRoy Dixon
Chairman/CEO
DAV/LEAR Systems, Inc.

Edward B. Fort
Chancellor
North Carolina A&T State University

Lori B. Garver
Executive Director
National Space Society

Robert Y. Huang
Chairman of the Board
Westwind Engineering Inc.

Donald B. Jacobs
Vice President, Advanced Projects (Ret.)
Boeing Corporation

Jack L. Kerrebrock
Professor of Aeronautics and Astronautics
Massachusetts Institute of Technology

Charles A. LeMaistre
President, M.D. Anderson Cancer Center
University of Texas

Jerry Mahlman
Director, Geophysical Fluid
Dynamics Laboratory
Princeton University

Duane T. McRuer
Chairman
Systems Technology Inc.

Bruce C. Murray
Professor of Planetary
Science and Geology
California Institute of Technology

Diana Natalicio
President
The University of Texas at El Paso

Arthur P. Osborne, Jr.
Vice President, Engineering
Lockheed Aeronautical Systems Co.

Jack Rosen
President, CEO, and Chairman
Continental Health Affiliates, Inc.

Robert A. Rosenberg
General Manager
Washington Operations
Science Applications
International Corporation

Vincila I. Sargent
Associate Director
Evans Valley Radio Observatory

Sidney A. Saville
Chemical Engineering Department
Princeton University

Richard Schwartz
President and CEO
Alliant Techsystems

Kathryn Sullivan
Chief Scientist
National Oceanic and
Atmospheric Administration

Lt. Gen. Thomas P. Stafford, USAF
Stafford, Burke and Hecker, Inc.
1006 Cameron Street
Alexandria, VA 22314

APR 7 1995

Dear Gen ~~Stafford~~: Tom

First, let me thank you and your task force for your excellent work in reviewing preparations in Russia for the Phase 1A missions (Soyuz TM-21, Mir 18 Main Expedition, and STS-71). I greatly appreciate the effort required to conduct such a comprehensive review and to produce a report in little more than two months. There is no question that the effort by you and the other members of the task force have made a significant contribution to the success of the Shuttle-Mir phase of the international Space Station program.

I have contacted the NASA Administrator, Mr. Daniel S. Goldin, and we would very much appreciate it if you could continue your review of the upcoming Shuttle-Mir missions, specifically incorporating lessons learned from missions already accomplished, and provide your recommendations with adequate time for implementation. Specific areas of interest are: use of the Orbiter Docking System on STS-71, analysis of STS-63 mission data for lessons learned and other data applicable to upcoming missions, and assessment of the flight readiness for the STS-71 and STS-74 missions.

In addition, I would ask that you continue your activities to review the overall NASA and associated contractor presence in Russia. Specific areas of interest are: the structure and relationship of NASA organizations participating in the Phase 1 program at all sites in Russia; the working relationship among civil servants and NASA contractors in Russia; the distribution of human resources between Phase 1 and Phase 2 activities, including the adequacy of current staffing levels; and the communications capability among NASA and contractor sites in Russia and locations in the United States.

Please include the results of these examinations in your next report. Again, thank you for all of your hard work and that of your Task Force and for your continued commitment to the success of the Human Space Flight Program.

Sincerely,

Brad.

Bradford W. Parkinson
Chair, NASA Advisory Council

cc: Mr. William L. Vantine

Appendix 3

Review Team Members

NASA Advisory Council Task Force on the Shuttle Mir Rendezvous and Docking Missions
Review Team Members

STS-71 and STS-74 Preparation Team

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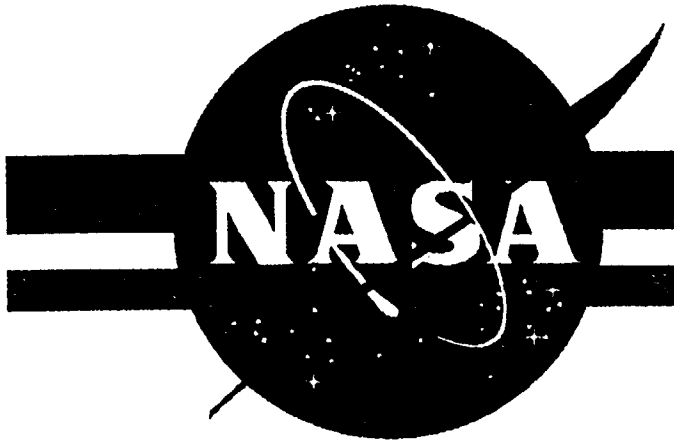
Appendix 4

ADP/T Team Shuttle-Mir Task Force
Final Report Presentation, July 19, 1995



SHUTTLE-MIR ADP/T REVIEW TEAM

ADP/T Team

Shuttle-Mir Task Force Final Report Presentation

July 19, 1995

Briefing Outline

- Task Background
- Purpose
- Review Team Members
- ADP/T Background
- Approach
- Process Overview
- Final Report, Findings, and Recommendations
- Continued Activities

Task Background

The critical role of automated data processing and telecommunications (ADP/T) capabilities was highlighted during Preliminary Working Group and Russian Review Team visits to Russia.

- The fourth Report of the Task Force on the Shuttle-Mir Rendezvous and Docking Missions, March 1, 1995, recommended that "...implementation of NASA institutional automated data processing and telecommunications (ADP/T) capabilities in Russia must be given a high priority."

- Dr. Bradford Parkinson's letter to Thomas Stafford on the Task Force on the Shuttle-Mir Rendezvous and Docking Missions, dated April 9, 1995, stated that "...I would ask that you continue your activities to...review the overall NASA and associated contractor presence in Russia...including the communications capability among NASA and contractor sites in Russia and locations in the United States."

Purpose

Review processes for collecting, prioritizing, and documenting requirements for the automated data processing/telecommunications (ADP/T) institutional resources necessary to support Russian participation in Phase 1 and Space Station, as well as the process for implementing and supporting the capabilities necessary to satisfy those requirements.

Review Team Members

David H. Mobley, NASA Chief Engineer, Lead

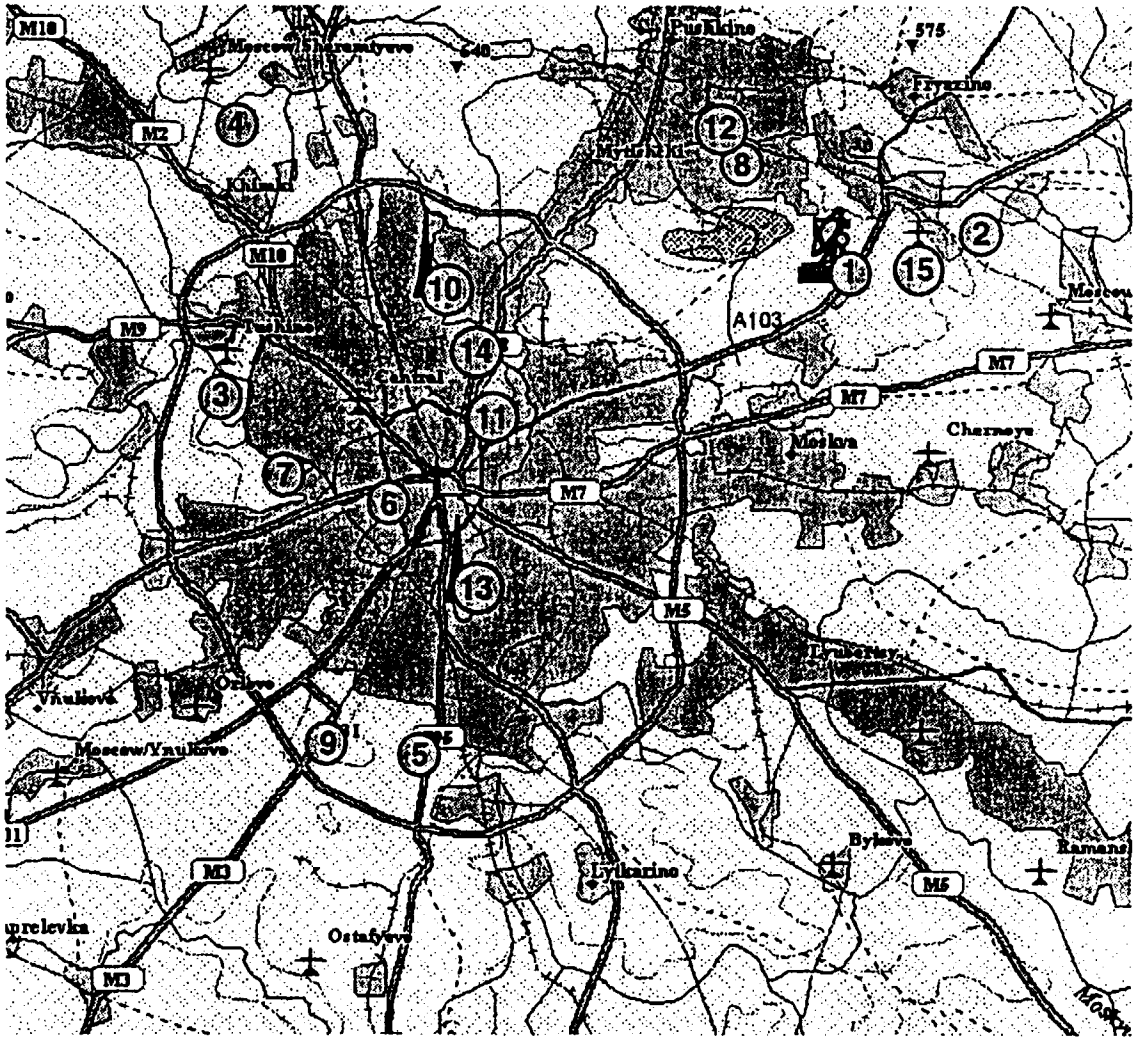
Dr. Judy Krause, I-NET

John Horan, I-NET

Perry Rogers, NASA KSC

Joe Cuzzupoli, American Pacific Corporation

Russian Locations



1. BEAR LAKE
2. GCTC, STAR CITY
3. IBMP-1
4. IBMP-2
5. IKI
6. LIAISON OFFICE, US EMBASSY
7. KHRUNICHEV
8. MMCC
9. MOSCOW STATE UNIVERSITY
10. NASA HUB, OSTANKINO TOWER
11. RSA
12. RSC-ENERGIA
13. SHUKOV TOWER
14. VOLGA APARTMENTS
15. CHKALOVSKY AFB

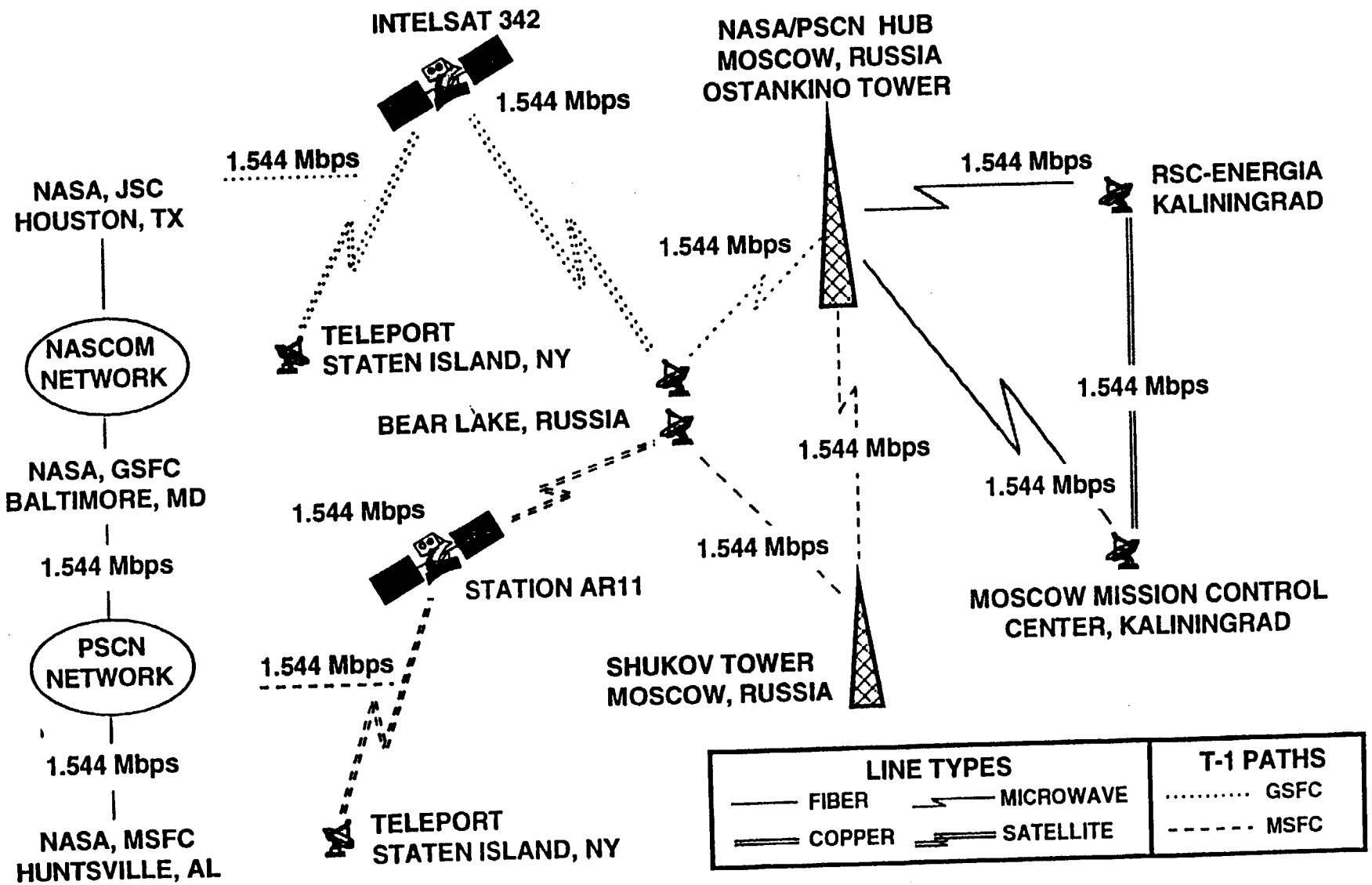
ADP/T Background

- Previous NASA work with the Russians on telecommunications:
  - US/Russian cooperation in space programs reflected in joint agreements
  - 1993, interim service installed by the Program Support Communications Network (PSCN) to:
    - Russian Institute of Space (RSC-Energia)
    - Institute for Biomedical Problems (IBMP)
    - Institute of Space Research (IKI)
  - 1993, the PSCN submitted design goals and concepts to provide long-term support for telecommunications requirements in Russia
    - RSC-Energia
    - IKI
    - IBMP
    - Gagarin Cosmonaut Training Center (GCTC), Star City
    - Russian Space Agency (RSA)
    - Mir Mission Control Center (MMCC)
    - Mytishchi
    - Khrunichev
    - NASA Moscow Technical Liaison Office (MTLO)

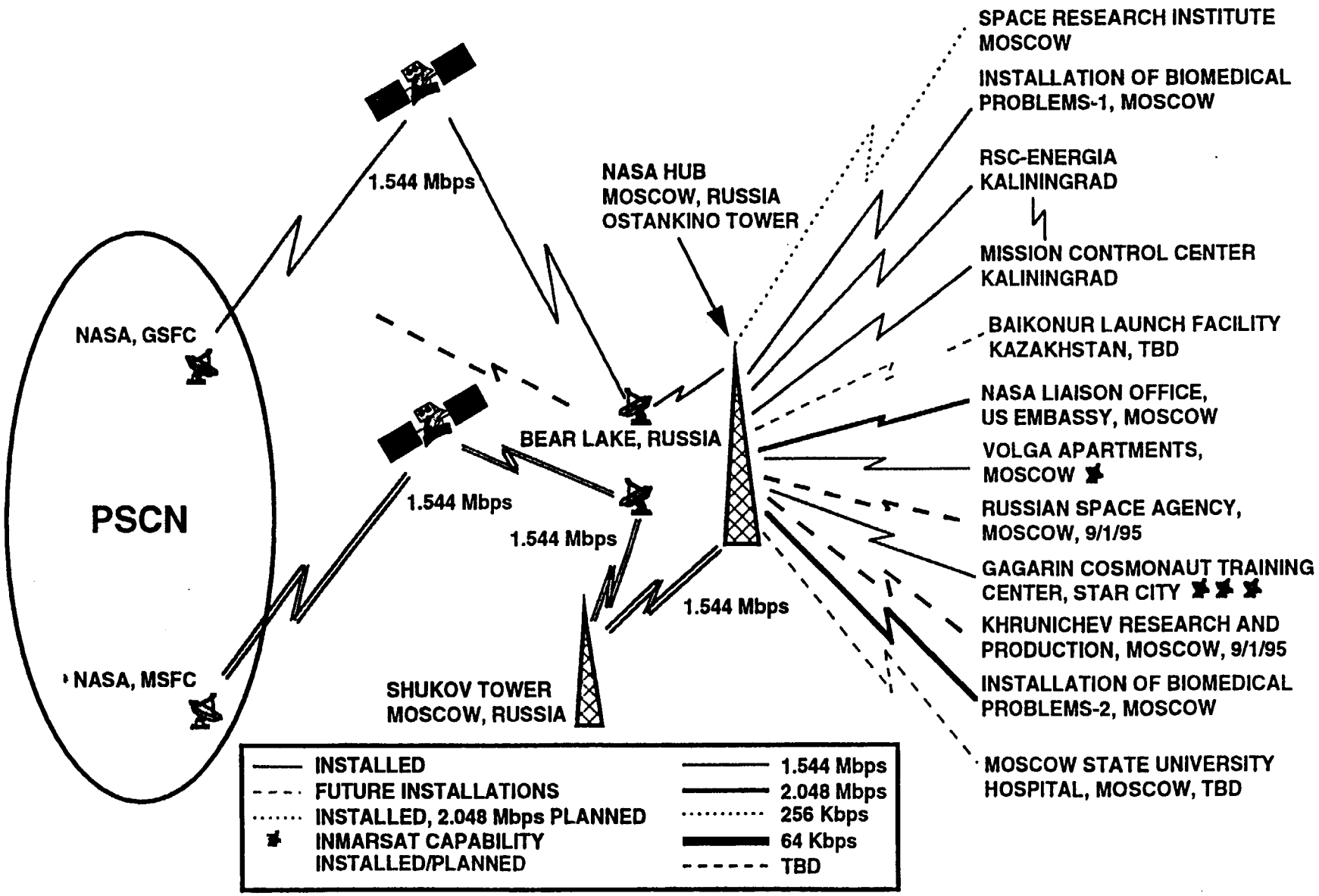
ADP/T Background (continued)

- Previous NASA work with the Russians on telecommunications: (continued)
  - 1994, telecommunications contract awarded to IDB, Worldcom by Computer Sciences Corporation (CSC) under contract to Marshall Space Flight Center (MSFC) PSCN for:
    - Installation
    - Operations and maintenance (O&M) for the Ostankino hub
    - Tail circuits to end user's locations
    - O&M of end user's equipment
  - Current status of telecommunications circuits in Russia from Ostankino hub:
    - Installed:
      - IKI
      - IBMP-1
      - RSC-Energia
      - MMCC
      - NASA Moscow Technical Liaison Office
      - Volga Apartments
      - IBMP-2

Mission Architecture: Current Status



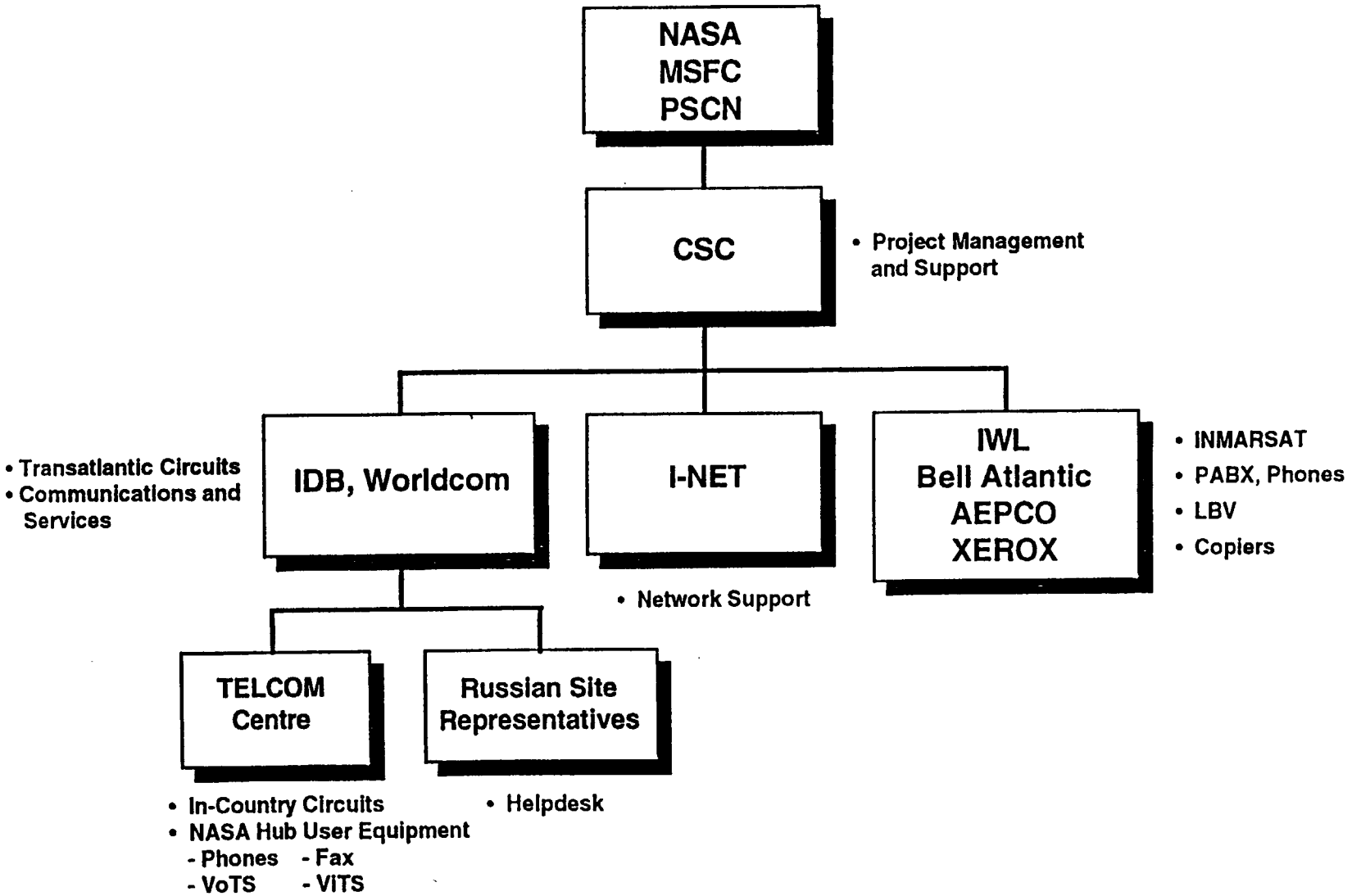
Russian Infrastructure Plan: Current Status



ADP/T Background (continued)

- Previous NASA work with the Russians on telecommunications: (continued)
  - Current status of communications circuits in Russia from Ostankino hub:
    - Planned:
      - RSA
      - Khrunichev
      - GCTC
    - TBD:
      - Moscow State University
      - Baikonur
  - Existing INMARSAT capability:
    - GCTC
    - Volga Apartments
    - MTLO

NASA Contracts Russian Project



PSCN Services Definition

- Telecommunication Backbone Services
  - Tail circuits
  - Channel banks and multiplexers
  - Routers

- End User Services
  - ADP (workstations, printers, and local area networks)
  - Copiers
  - Facsimile (Fax)
  - Voice services
  - VoTS (voice teleconferencing system)
  - ViTS (video teleconferencing system)

Approach

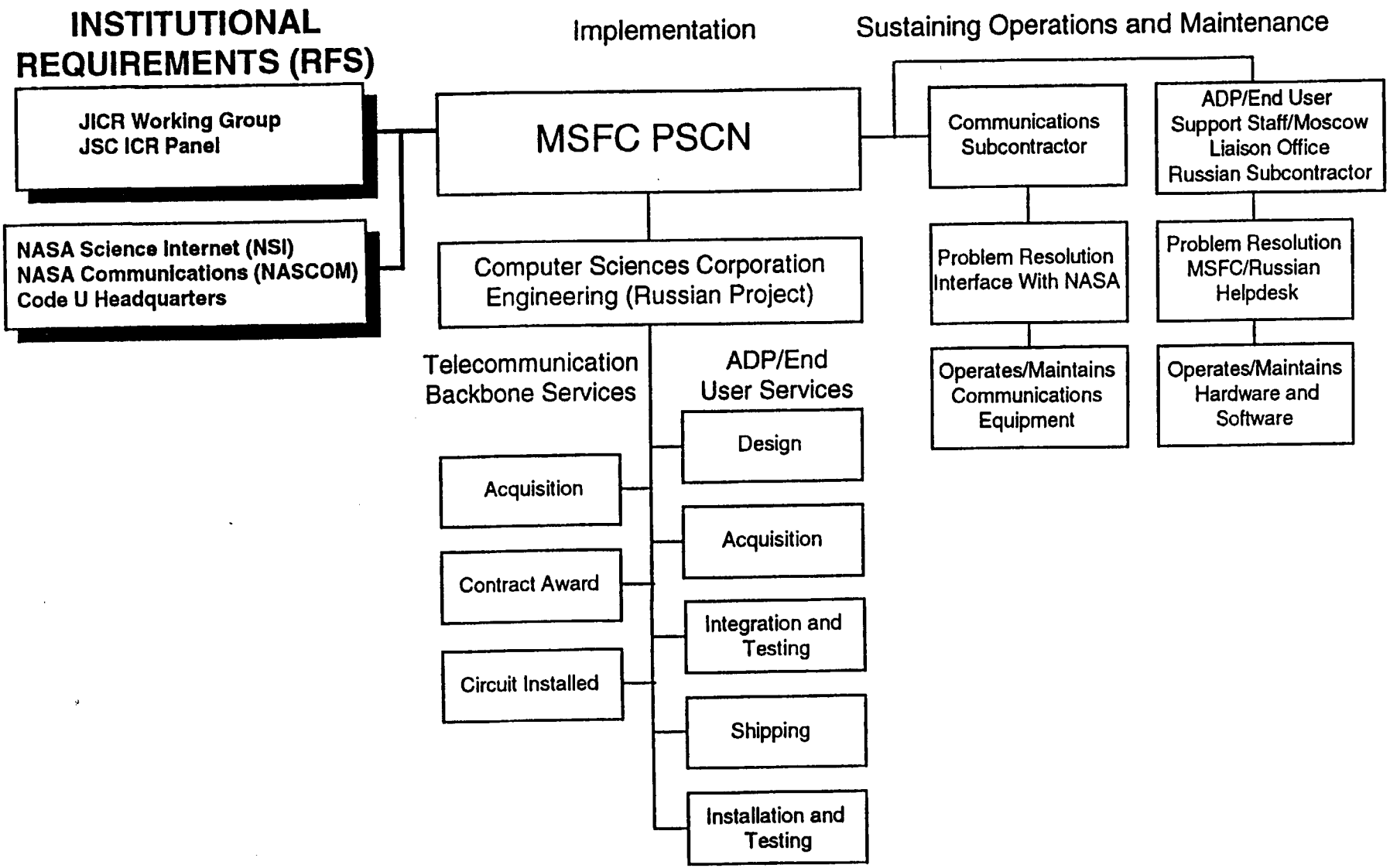
The team reviewed the requirements identification, service implementation, and sustaining O&M processes necessary to provide ADP/T resources required to support Russian participation in Phase 1 and Space Station.

- Team members conducted considerable research:
  - Obtained and reviewed a wide range of source materials
  - Received briefings from both user organizations: Johnson Space Center (JSC) and the service provider (MSFC PSCN)
  - Attended a regular meeting of user organizations [Joint Institutional Communications Requirements (JICR) Working Group and JSC Institutional Communications Requirements (ICR) Panel]

Approach (continued)

- Team members conducted considerable research: (continued)
  - Conducted interviews with a number of major participants
    - Barry Waddell and the JICR Working Group/Panel members
    - JSC PSCN, Marianne Campbell
    - Space Station Program sponsor, Debbie Williams
    - MSFC/NASA PSCN, Carl Stover, Kathy Hatley, and Gene Leckie
    - NASCOM, V. Hall; NSI, B. Jones; and Code U/HQ, Chuck Doarn
    - CSC Russian Project Lead, Sandy George
    - MSFC CSC/I-NET Engineering, Operations, Helpdesk, Network Control Center, NASA Teleconferencing Center
    - IDB WorldCom, major communications subcontractor to CSC
  - Participated in working sessions with MSFC PSCN for identification of the following processes: requirements, implementation, sustaining operations and maintenance, service management, travel preparation, Request For Service (RFS) traceability, schedule interfaces, management structure, and configuration management control and documentation.
  - Conducted telecon with Kenny Mitchell, NASA MTLO, and Mike Baker, Director of Operations for Russian Projects, Star City.

Process Overview

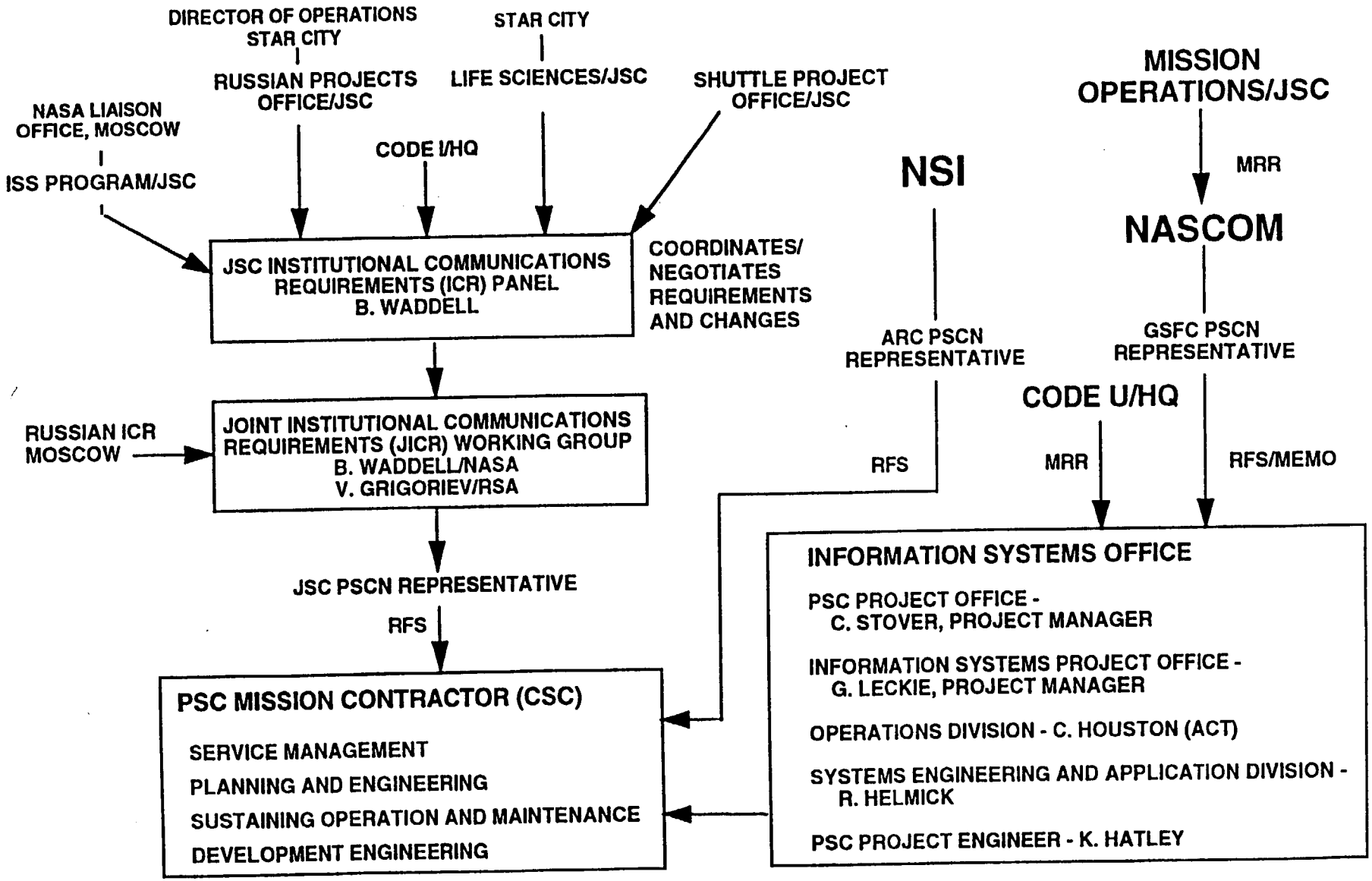


Final Report, Findings, and Recommendations

- **Finding 1**

In the team's opinion, the processes for the collection of requirements and the implementation of those requirements are adequate and working.

Russian Requirements Flow



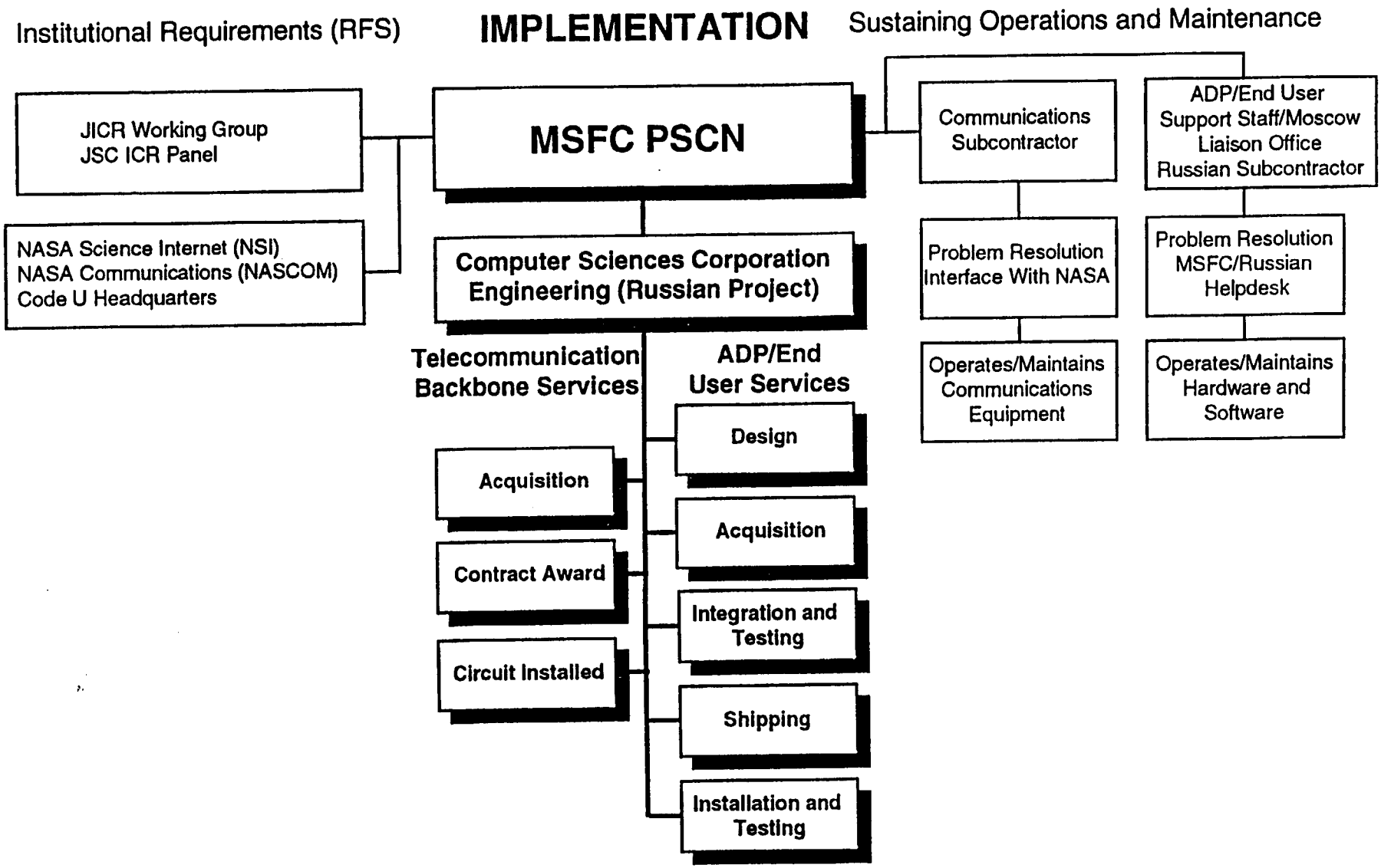
Final Report, Findings, and Recommendations (continued)

- Institutional Requirements

  There have been significant changes/improvements in the processes of collecting Phase 1 Space Station requirements and transmitting them to the PSCN by the establishment of the JICR Working Group and the JSC ICR Panel. The team reviewed processes associated with the Communications Requirements Working Group and Panel, NASCOM, NSI, and Code U/HQ ADP/T requirements to the PSCN.

  - **Observation 1:**
    - The Joint US/Russian Institutional Communications Requirements Document has not been agreed to and signed between NASA and RSA.
      - Design and acquisition are proceeding at risk.
      - Site implementation plans cannot be finalized.
  - **Recommendation:**
    - JICR continue process until JICR document is signed with RSA.
    - Target date is July 28, 1995 (B. Waddell).

Process Overview



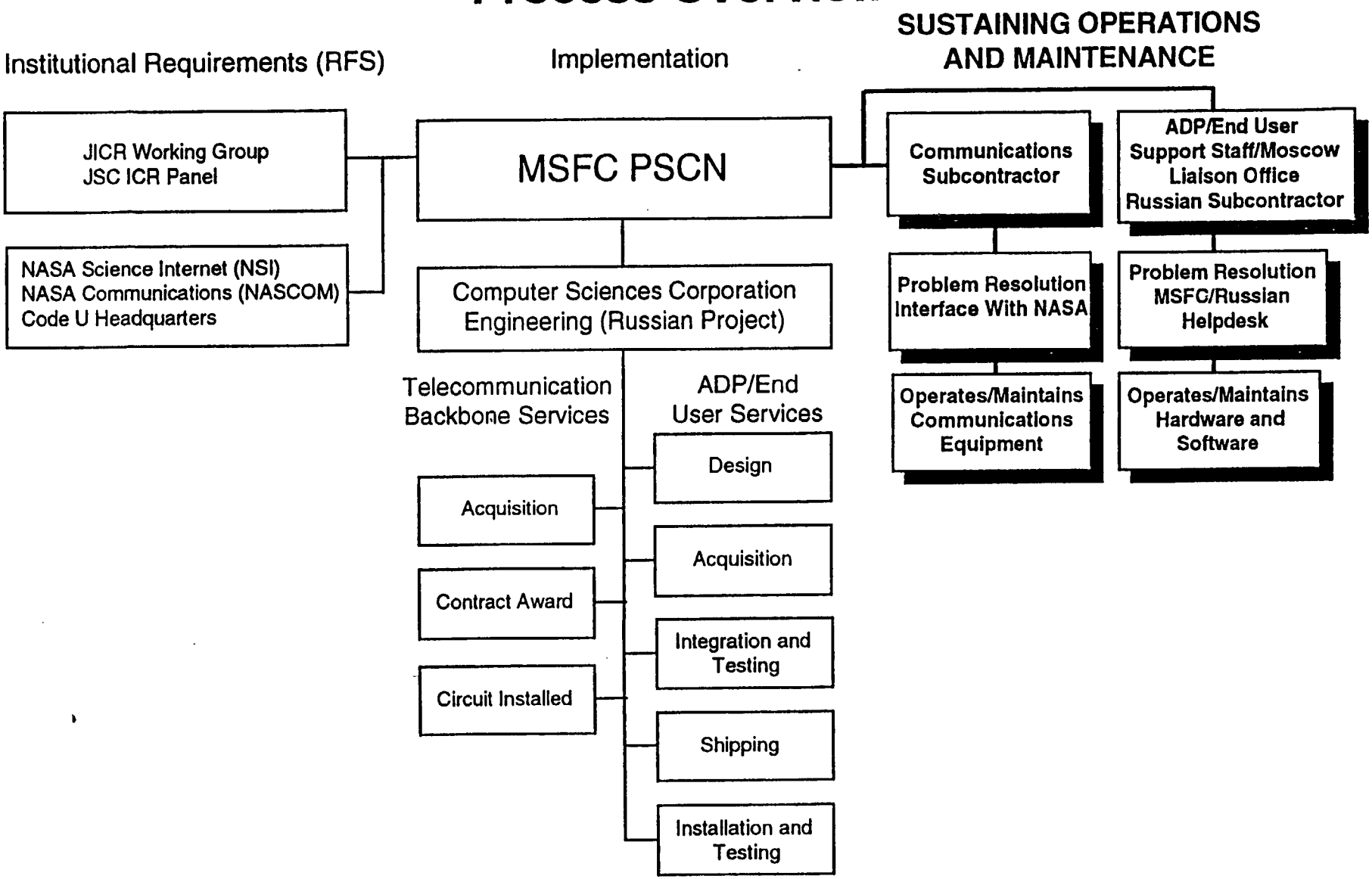
Final Report, Findings, and Recommendations (continued)

- Implementation

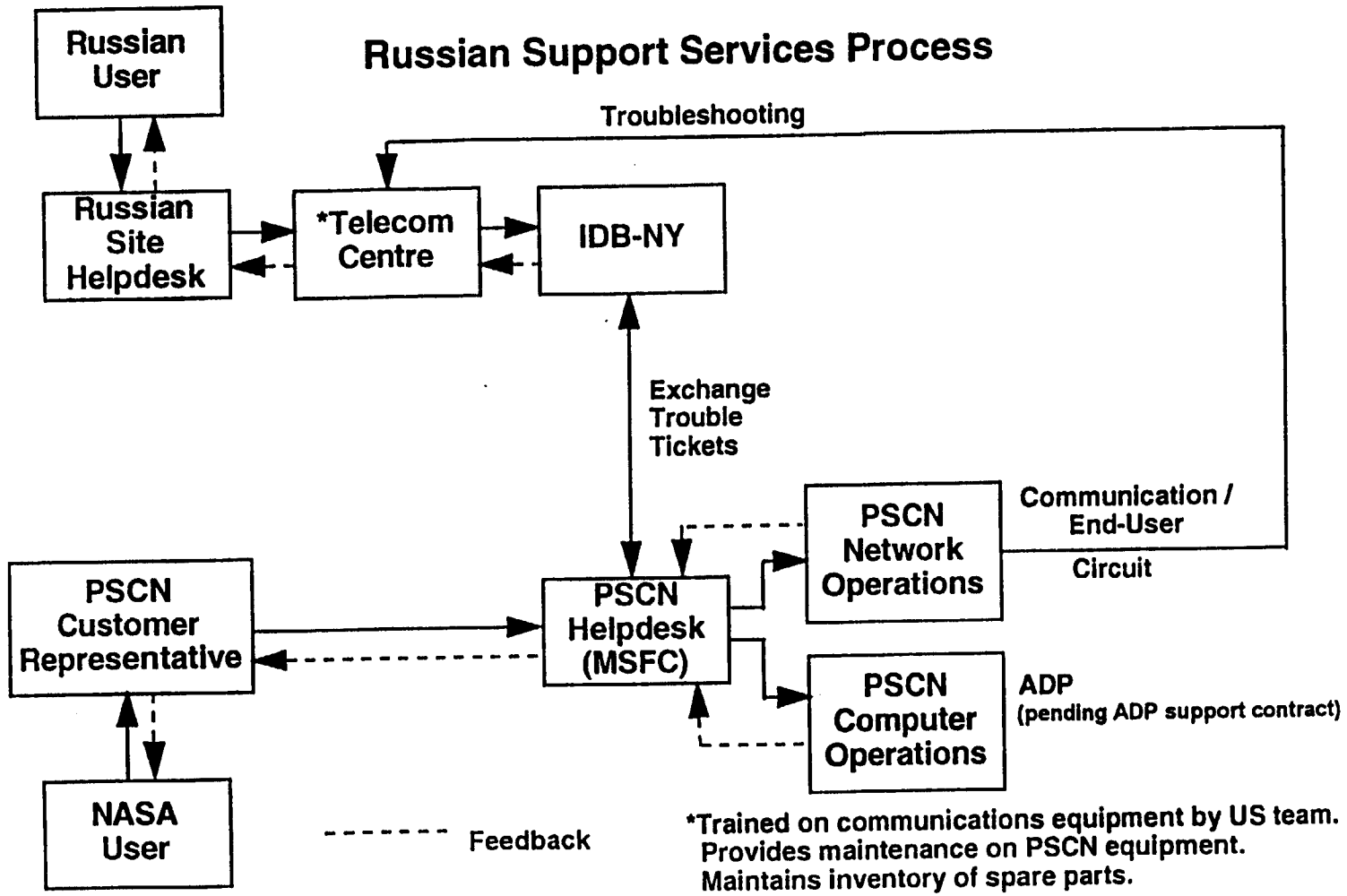
  The team reviewed PSCN's implementation processes that include design, acquisition, integration and testing, shipping, installation and testing, and support.

  - **Observation 2:**
    - Site-specific implementation plans have not been finalized.
  - **Recommendation:**
    - Site-specific implementation plans should be finalized within 6 weeks following RSA/NASA joint signing of JICR document.
    - Russian Institutional Communications Director be responsible for implementing the site-specific plans. (See finding 2.)
  - **Observation 3:**
    - User information data package needed for equipment/software to be utilized in Russia.
  - **Recommendation:**
    - PSCN include instructions for users of equipment/software as part of the deliverable package.
    - Training request should be addressed on a case-by-case basis.

Process Overview

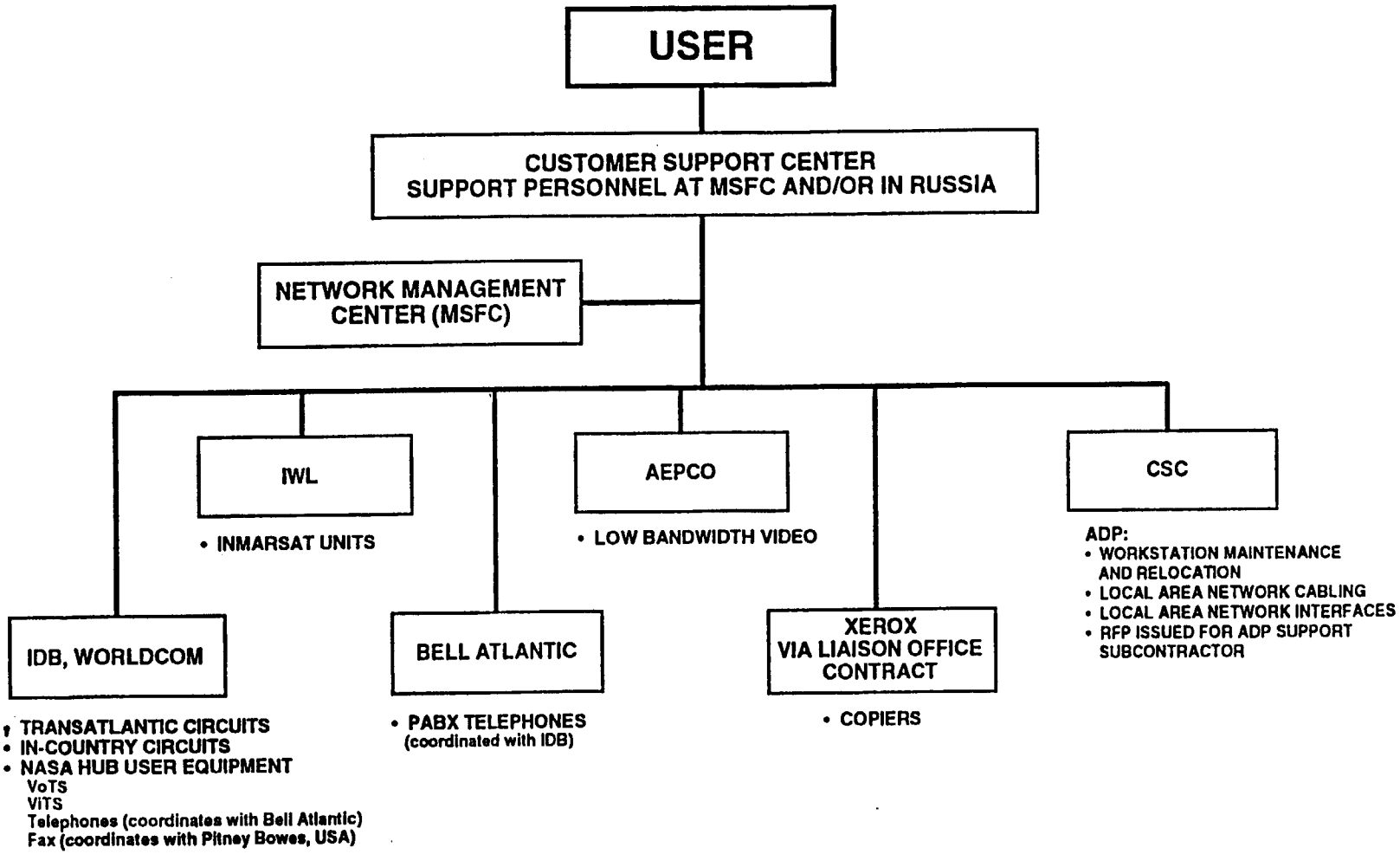


Sustaining Operations and Maintenance



Sustaining Operations and Maintenance

Russian Operations and Maintenance Support Interfaces



Final Report, Findings, and Recommendations (continued)

- Sustaining Operations and Maintenance

PSCN processes for sustaining operations and maintenance include Russian and NASA support.

- **Observation 4:**
  - Logistics and depot maintenance plan needed for equipment in Russia.
- **Recommendation:**
  - Develop logistics and depot maintenance plan to include funding needed prior to implementation.
- **Observation 5:**
  - Lack of a property control/inventory system for equipment located in Russian facilities.
- **Recommendation:**
  - Develop property control/inventory system for all equipment located in Russian facilities, including portable ADP equipment located at MTLO.
- **Observation 6:**
  - Lack of a contractor to provide ADP support in Russia.
- **Recommendation:**
  - Selection of a contractor to provide ADP support in Russia.
  - Request for Proposal (RFP) released.
  - Contract to be awarded mid-September 1995.

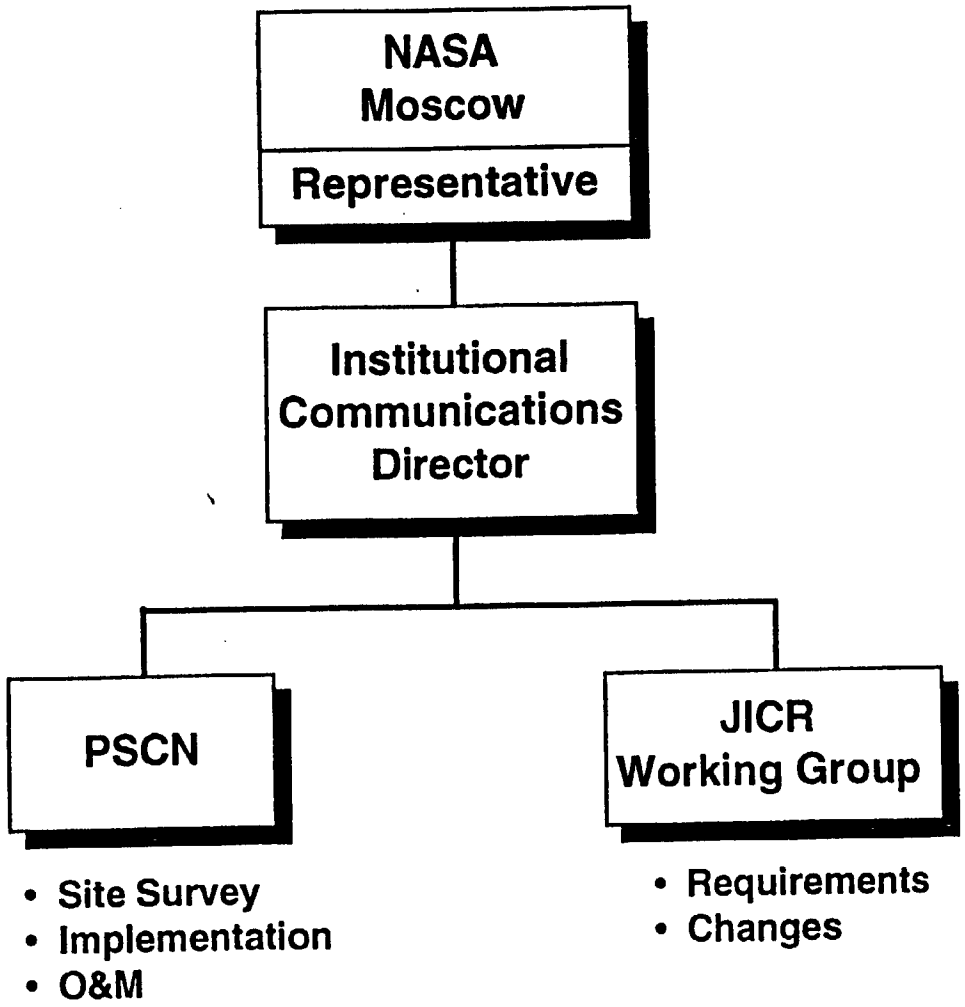
Final Report, Findings, and Recommendations (continued)

- Management

  - **Finding 2:**
    - There is not a single identifiable manager responsible for the total process.

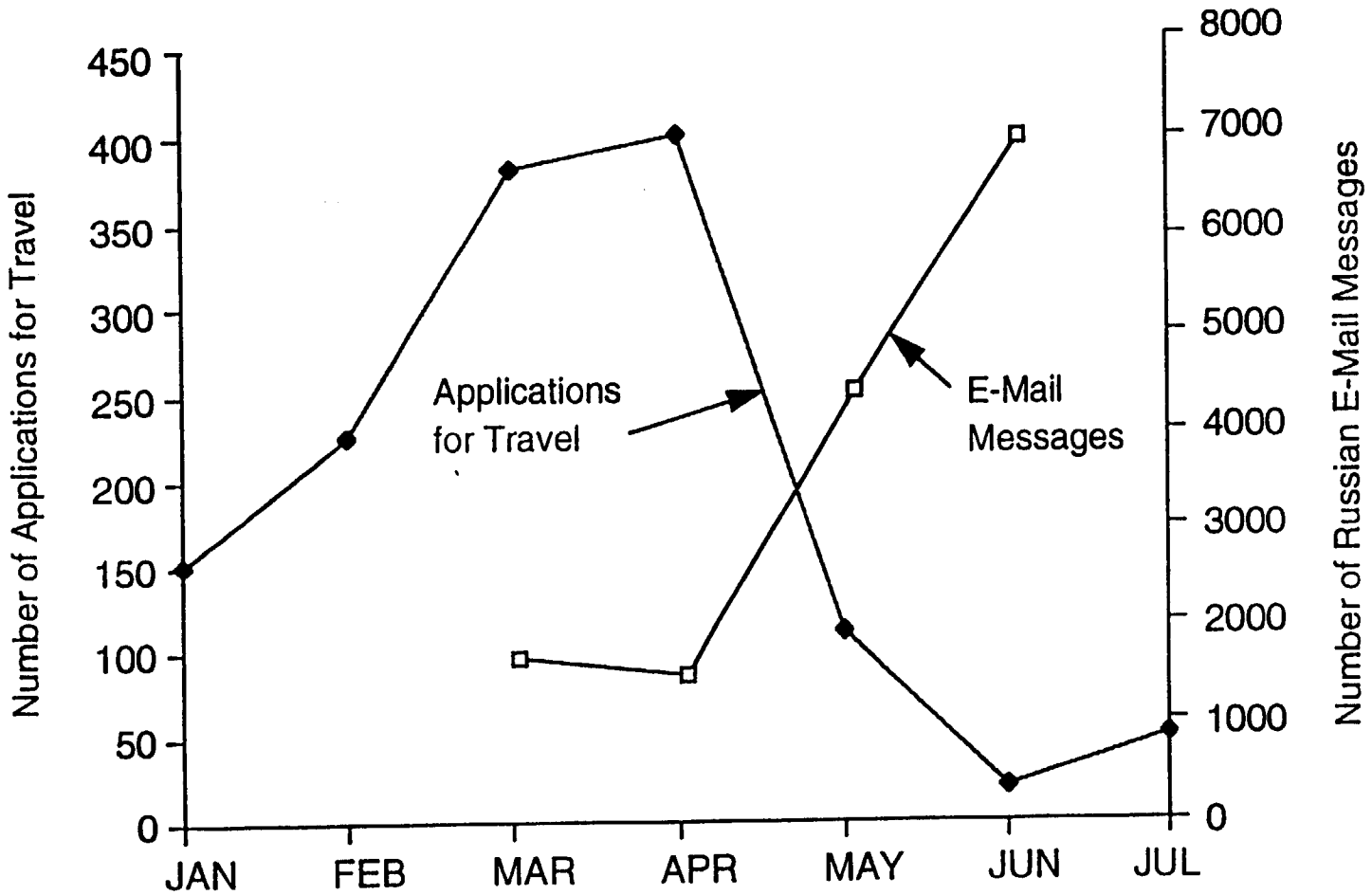
  - **Recommendation:**
    - Management and control from Russia via establishment of a new position of an Institutional Communications Director.
      - Reports directly to the NASA Moscow Senior Representive. (See management presentation of 7/9/95.)
      - Contracting Officer Technical Representative for O&M contracts.
      - Approves all changes to the signed JICR requirements document.
      - Responsible for budget controls.
      - Coordinates activities with MSFC management.

Proposed Organization



Continued Activities

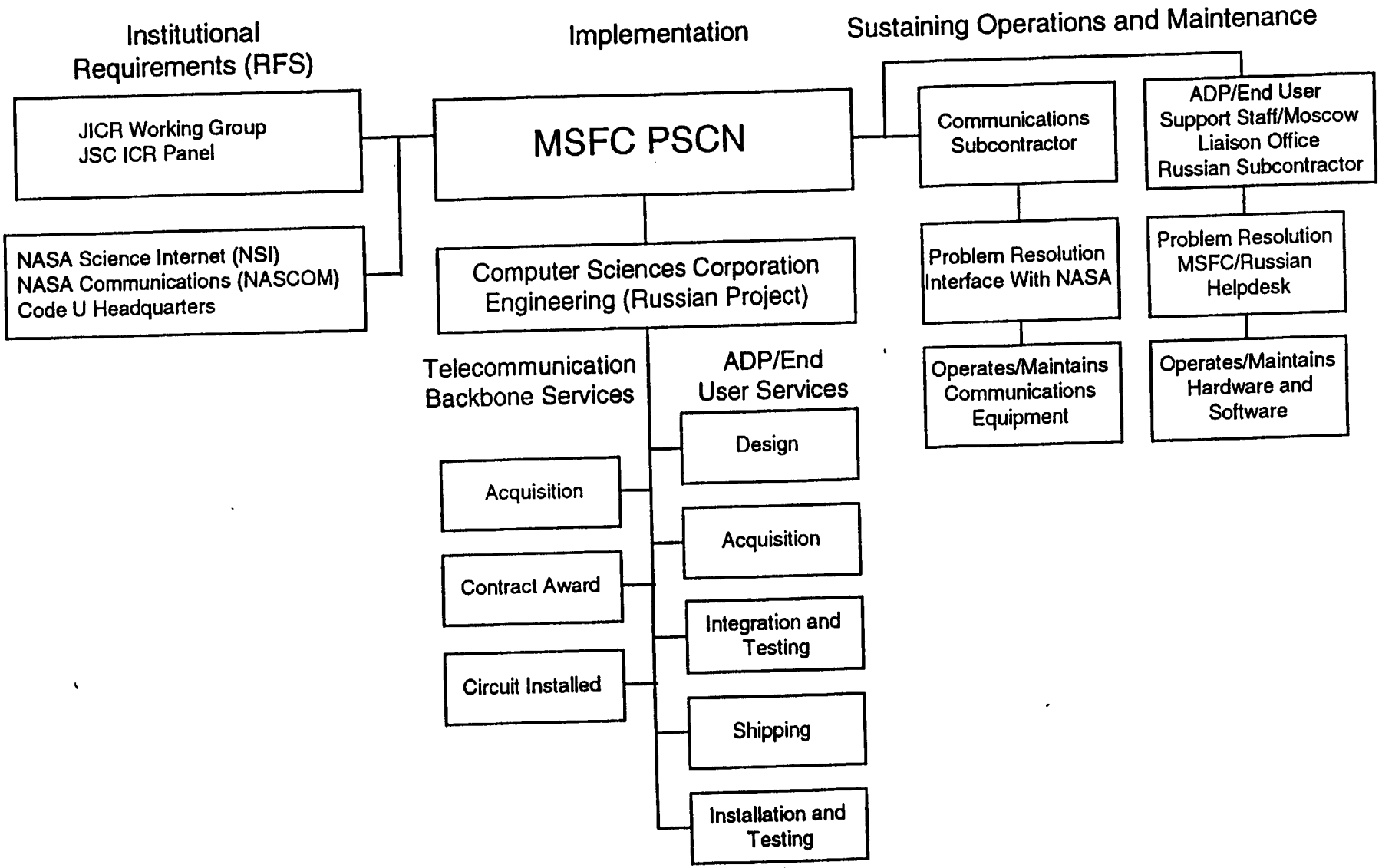
- ADP/T team temporarily disband
- Six-month task to provide continuity (MSFC est. of 1 man)
- Reconvene team in October timeframe
  - Part of STS-74 team
- Revisit status of:
  - Requirements
  - Site implementation plans
  - Sustaining operations and maintenance
  - Visit of Russian sites
- Delta report


Number of Applications for Travel
450
400
350
300
250
200
150
100
50
0
Applications for Travel
E-Mail Messages
8000
7000
6000
5000
4000
3000
2000
1000
0
Number of Russian E-Mail Messages
JAN
FEB
MAR
APR
MAY
JUN
JUL

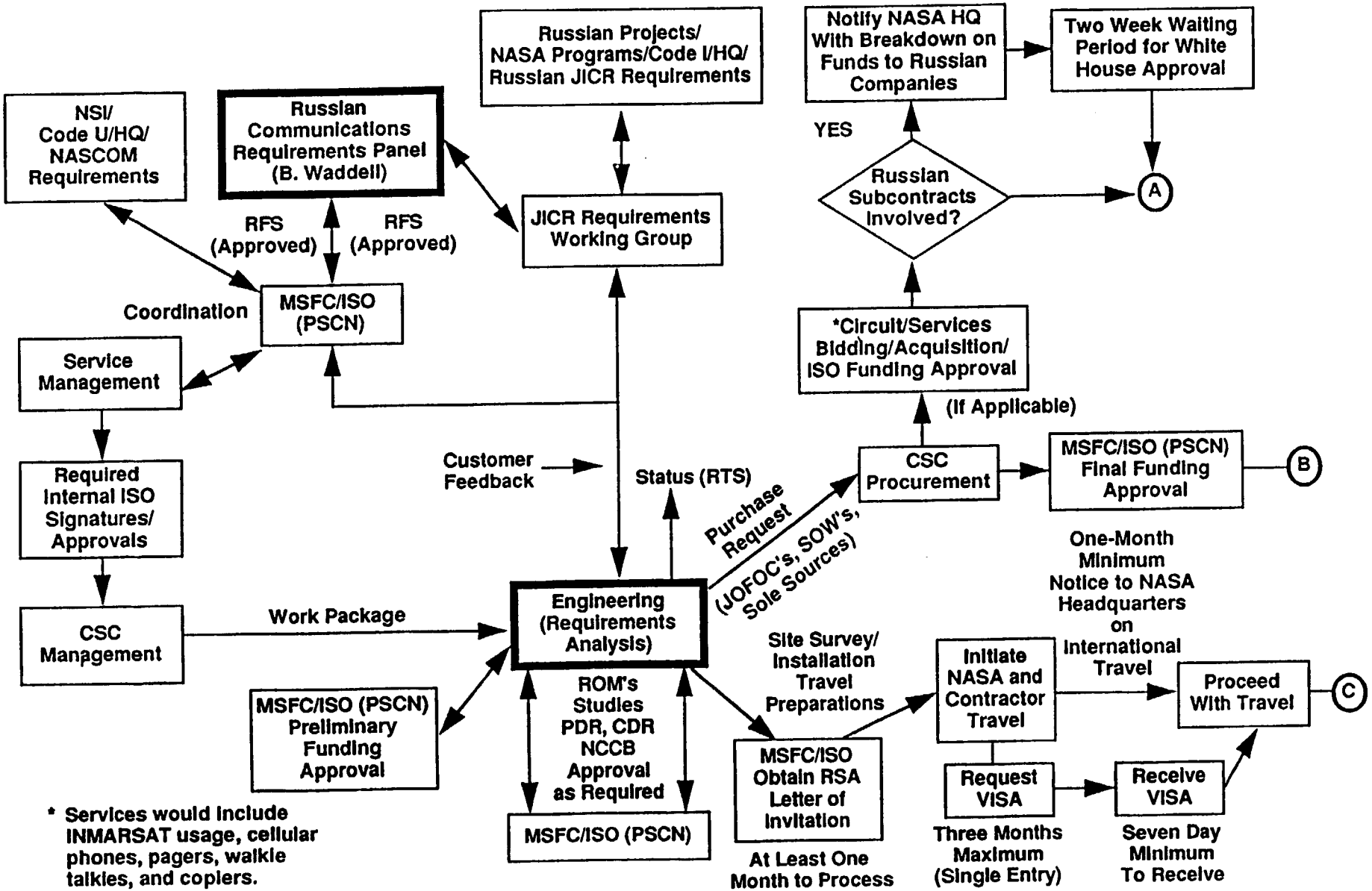
Acronyms and Abbreviations

ADP/T	Automated Data Processing/Telecommunications
AFB	Air Force Base
ARC	Ames Research Center
CSC	Computer Sciences Corporation
GCTC	Gagarin Cosmonaut Training Center
GSFC	Goddard Space Flight Center
HQ	Headquarters
IBMP	Institute for Biomedical Problems
ICR	Institutional Communications Requirements
IKI	Institute of Space Research
ISS	International Space Station
JICR	Joint Institutional Communications Requirements
JSC	Johnson Space Center
Kbps	Kilobit per second
KSC	John F. Kennedy Space Center
Mbps	Megabit per Second
MMCC	Mir Mission Control Center
MRR	Mission Requirement Request
MSFC	Marshall Space Flight Center
MTLO	Moscow Technical Liaison Office
NASA	National Aeronautics and Space Administration
NASCOM	NASA Communications
NSI	NASA Science Internet
O&M	Operations and Maintenance
PSC	Program Support Communications
PSCN	Program Support Communications Network
RFP	Request for Proposal
RFS	Request for Service
RSA	Russian Space Agency
RSC	Russian Institute of Space
TBD	To Be Determined
US	United States
ViTS	Video Teleconferencing System
VoTS	Voice Teleconferencing System

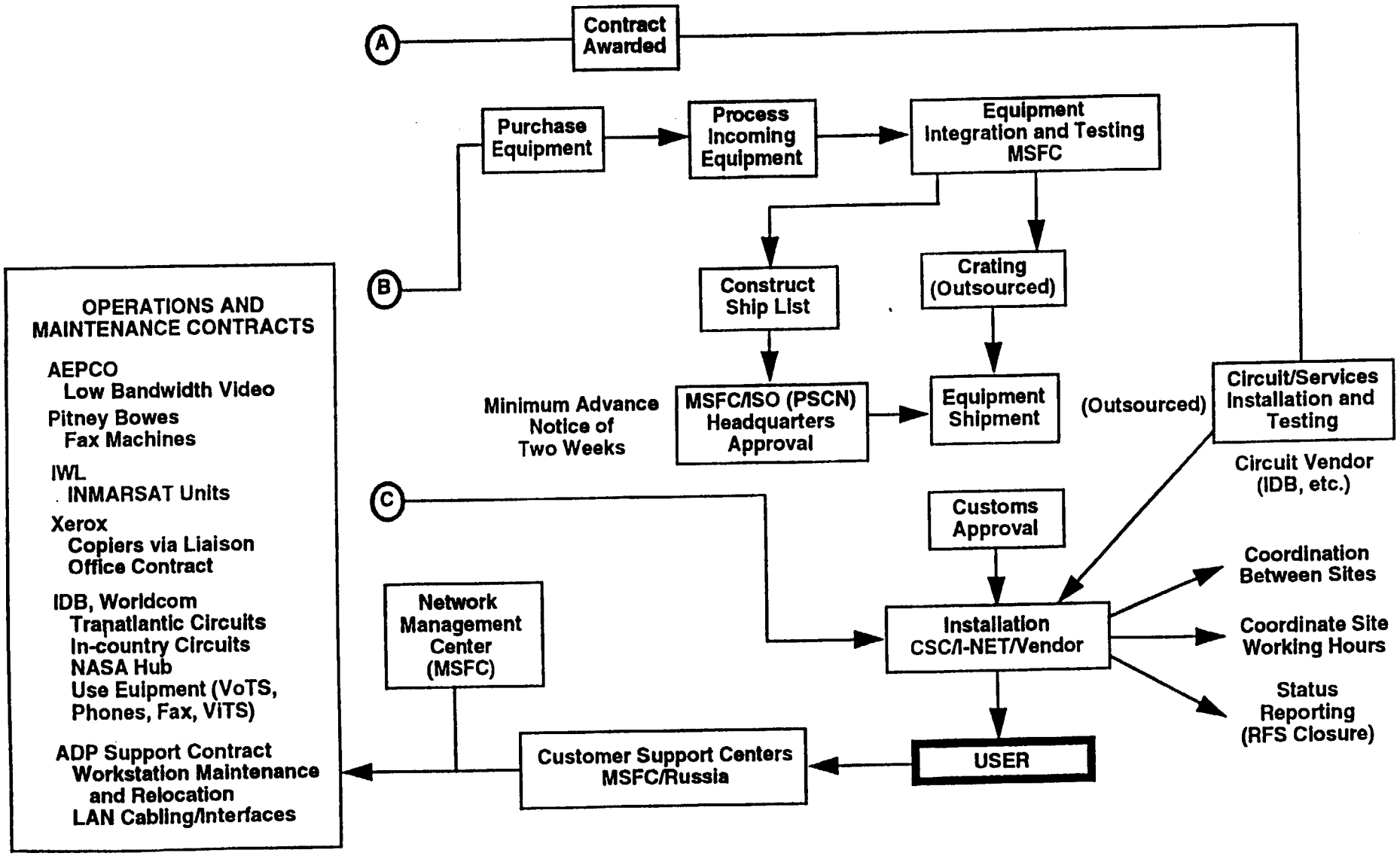
Process Overview



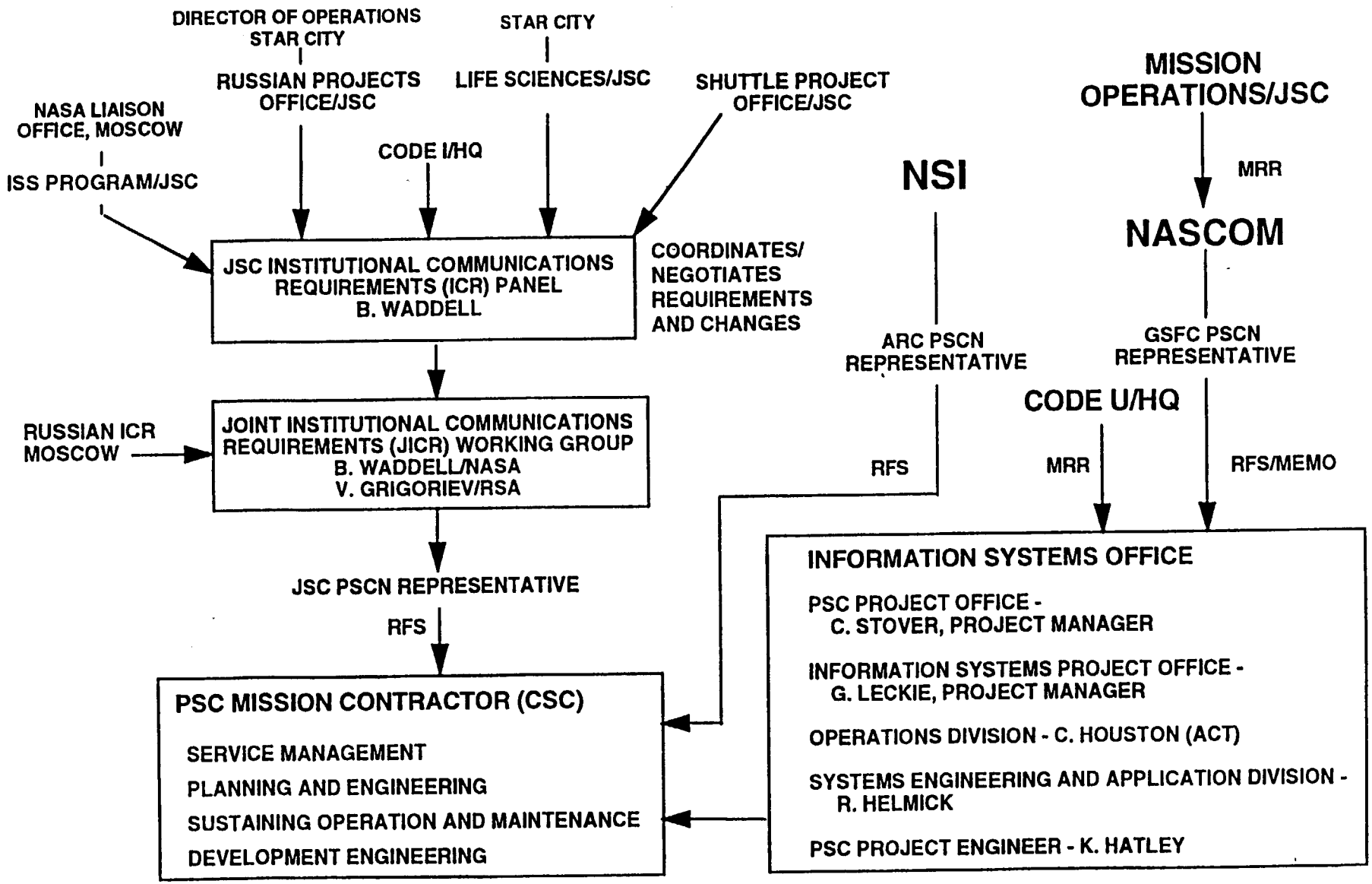
PSCN Russian Requirements Implementation Workflow



PSCN Russian Requirements Implementation Workflow (Cont)

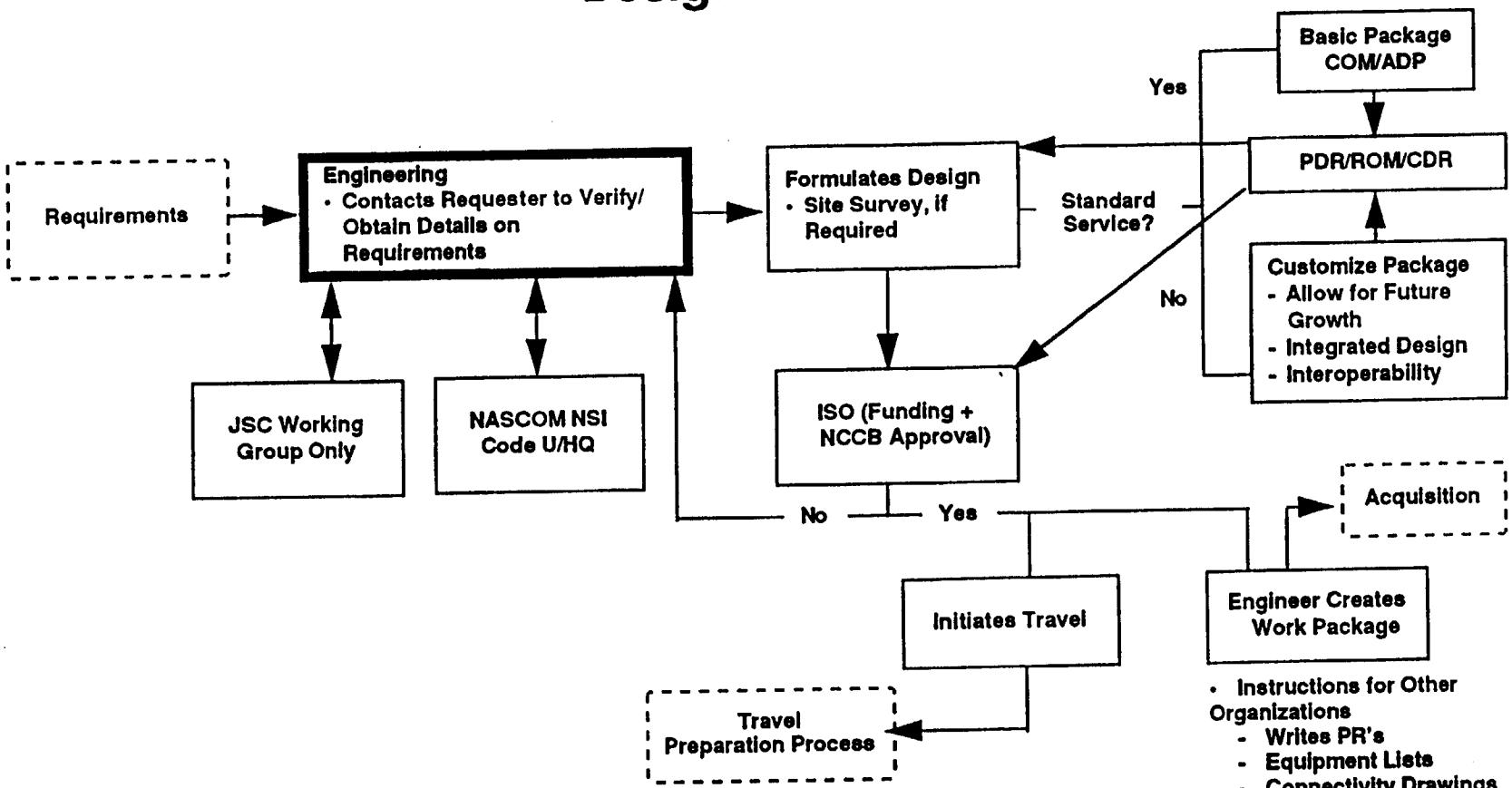


Russian Requirements Flow



Implementation

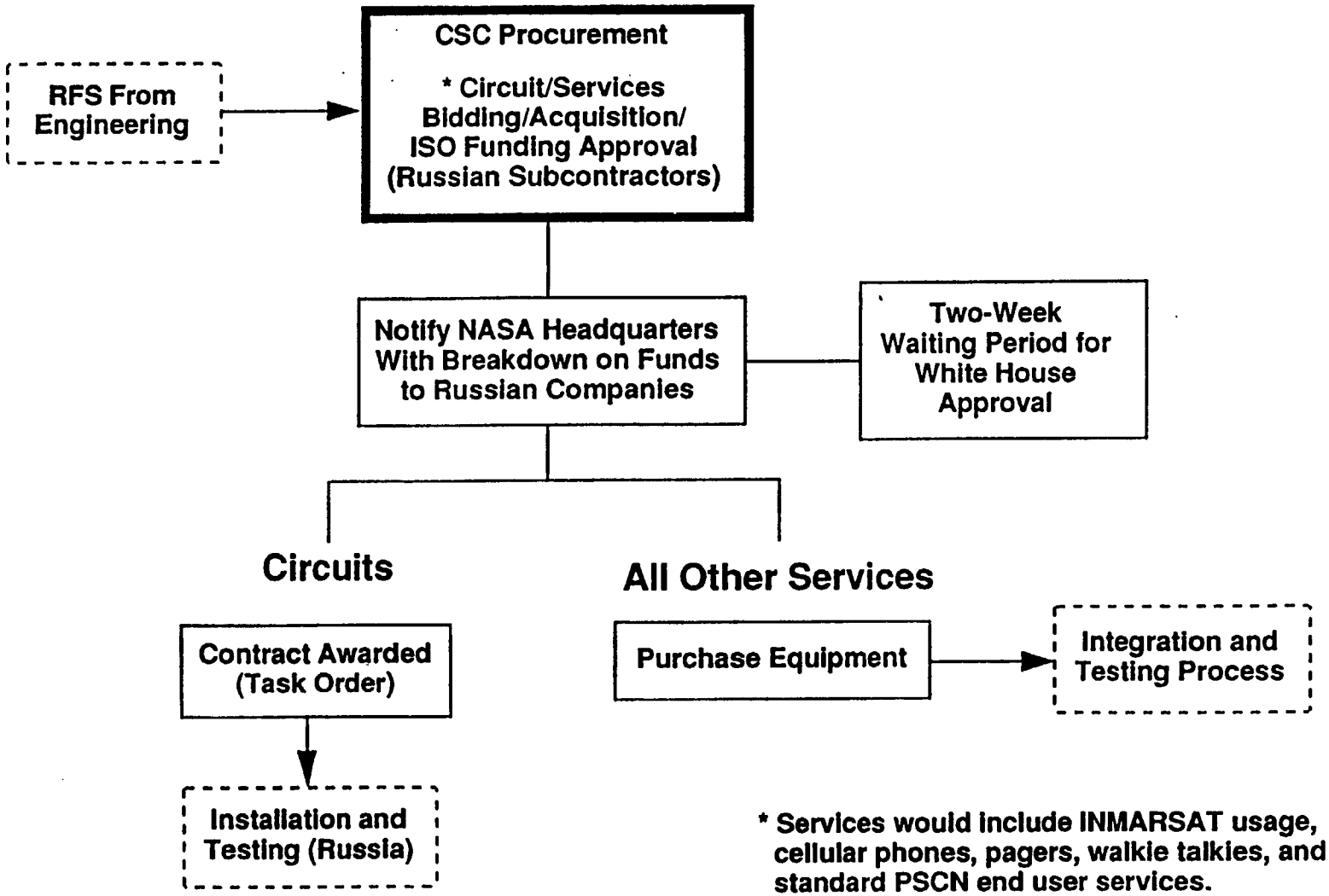
Design Process



*Note:
Determination of Integration of Design
- Go to Existing Configuration Control Documents
- Knowledge Based on History of Project

Implementation

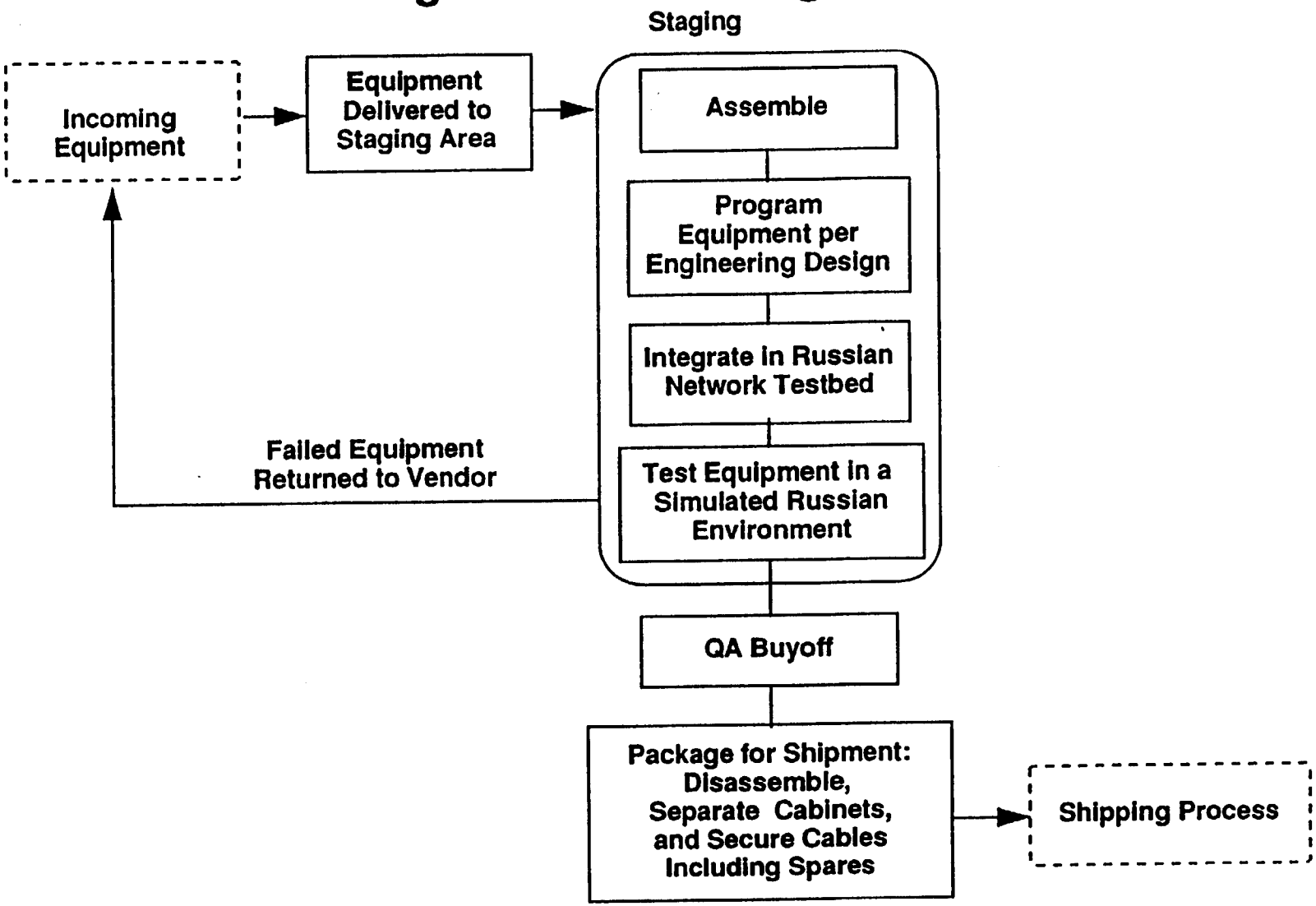
Acquisition Process



* Services would include INMARSAT usage, cellular phones, pagers, walkie talkies, and standard PSCN end user services.

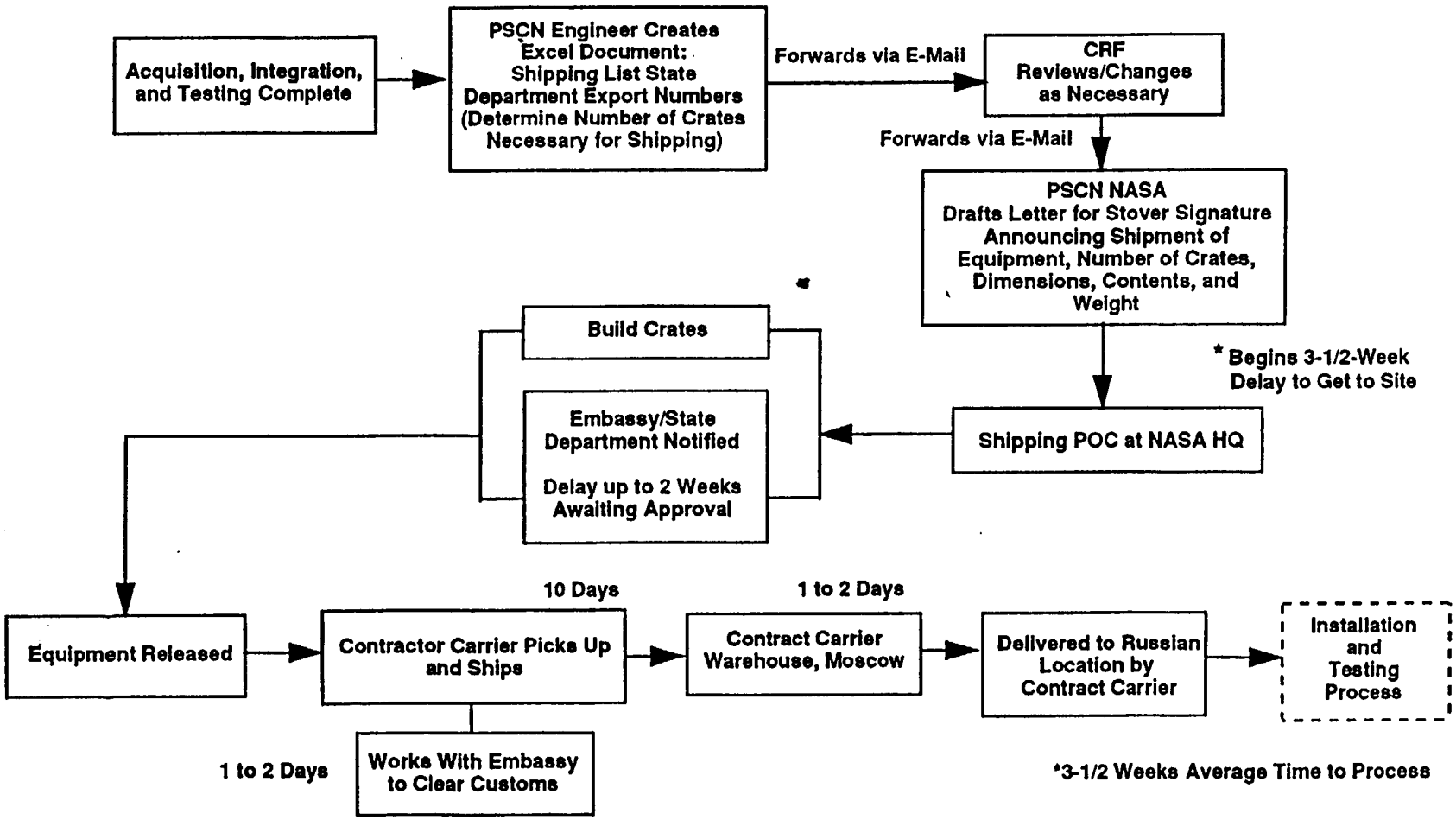
Implementation

Integration and Testing Process



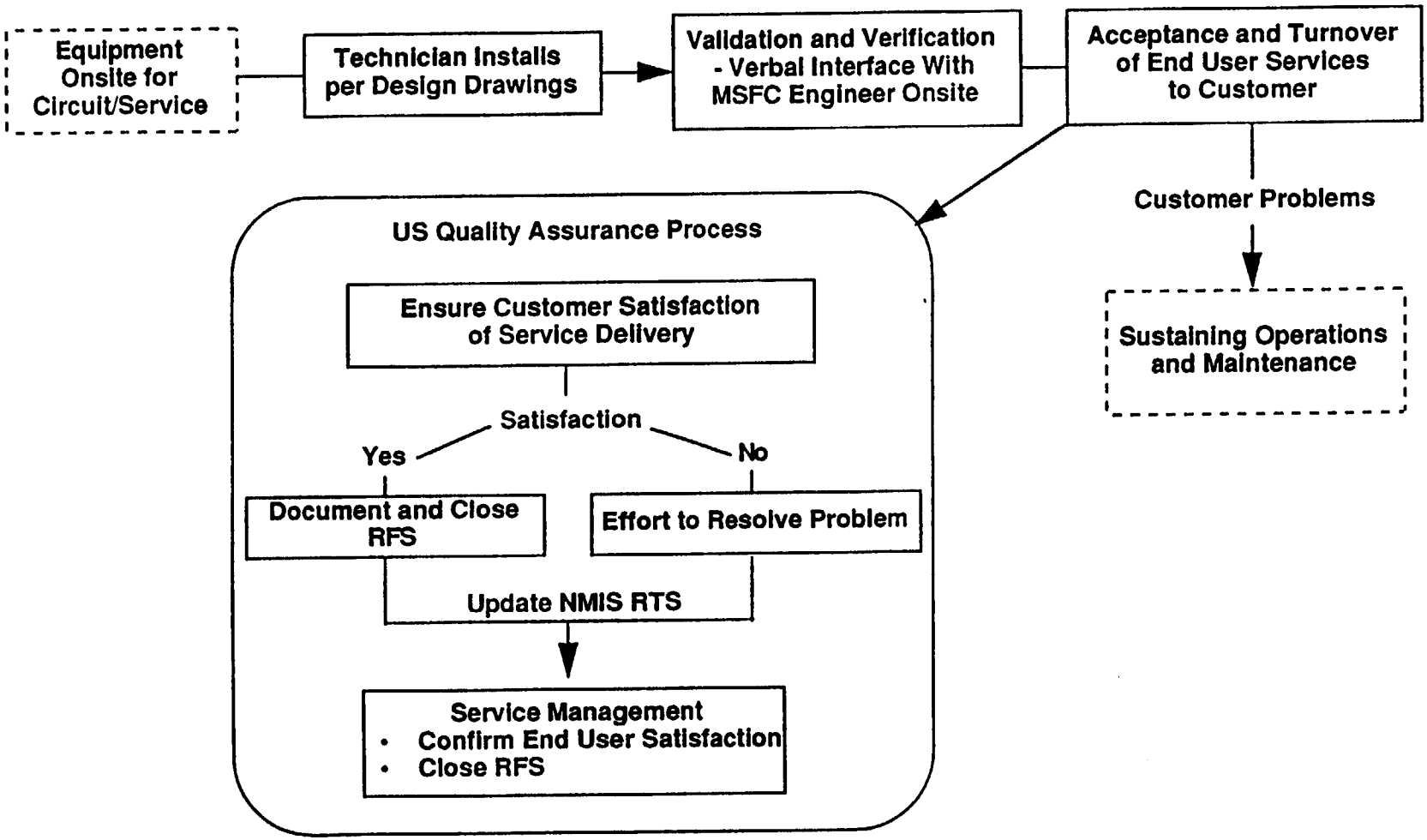
Implementation

Shipping Process



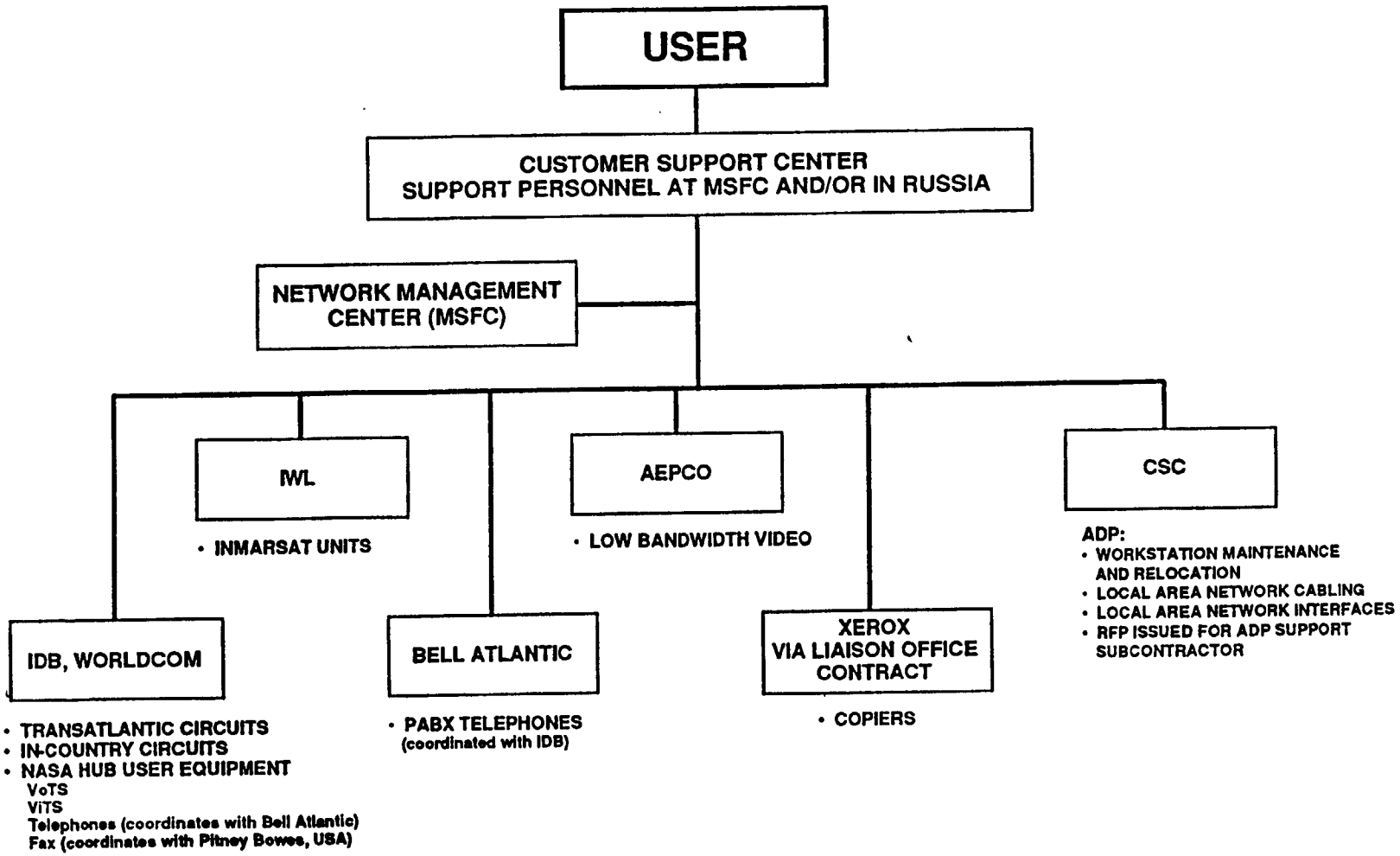
Implementation

Installation and Testing Process (Russia)

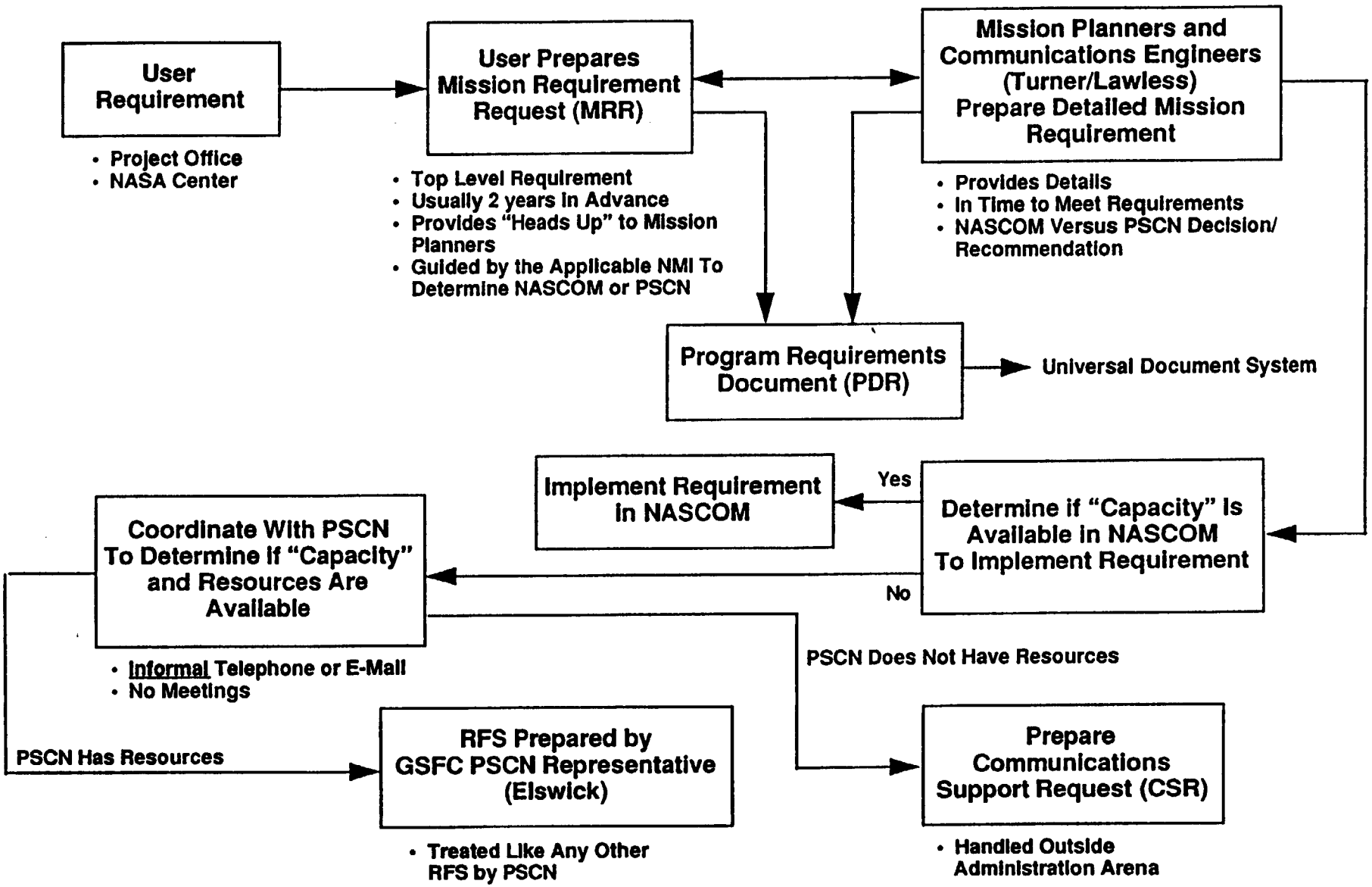


Sustaining Operations and Maintenance

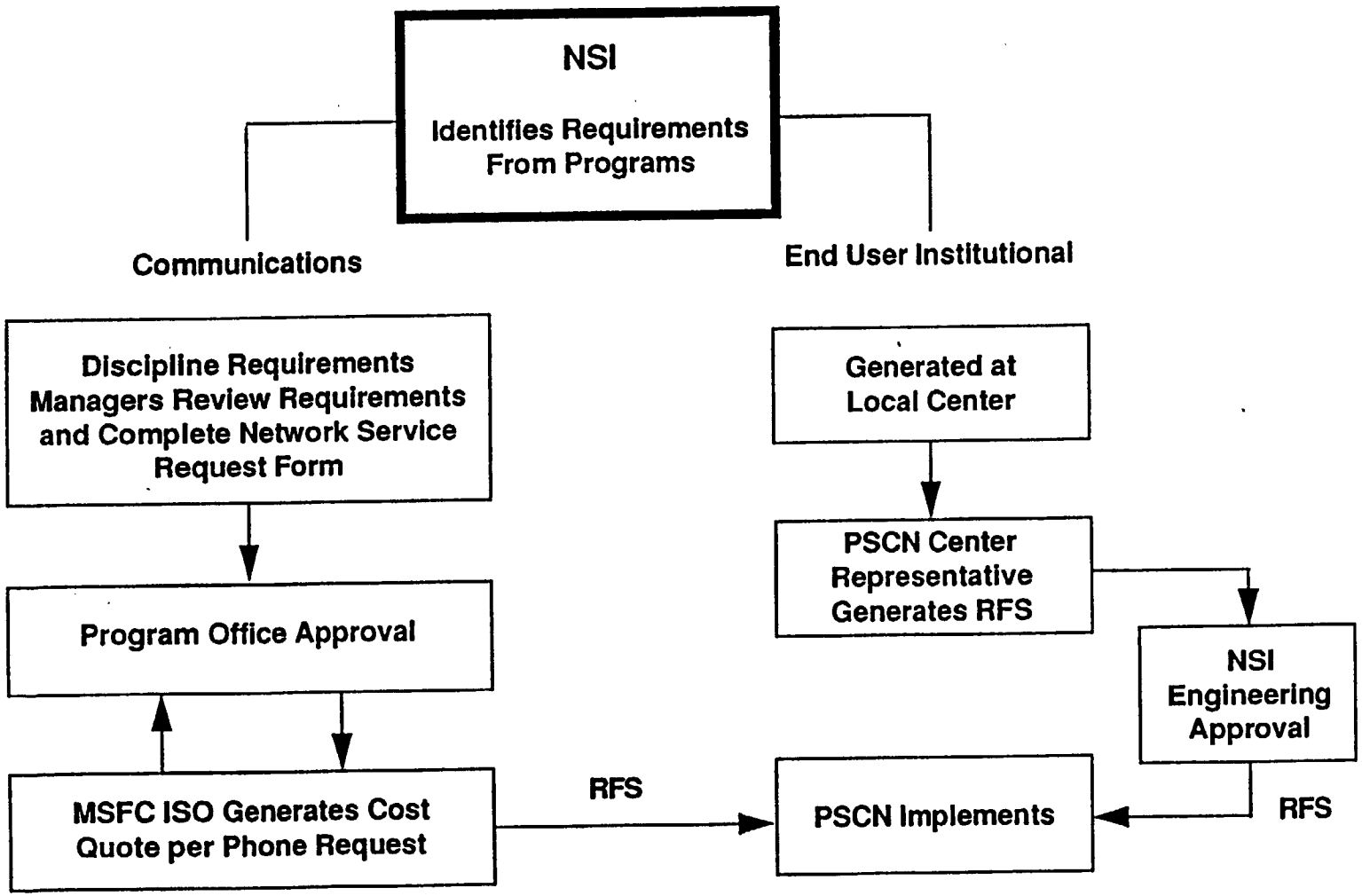
RUSSIAN OPERATIONS AND MAINTENANCE SUPPORT INTERFACES



NASCOM Requirements Collection and Interface With Administrative Communications

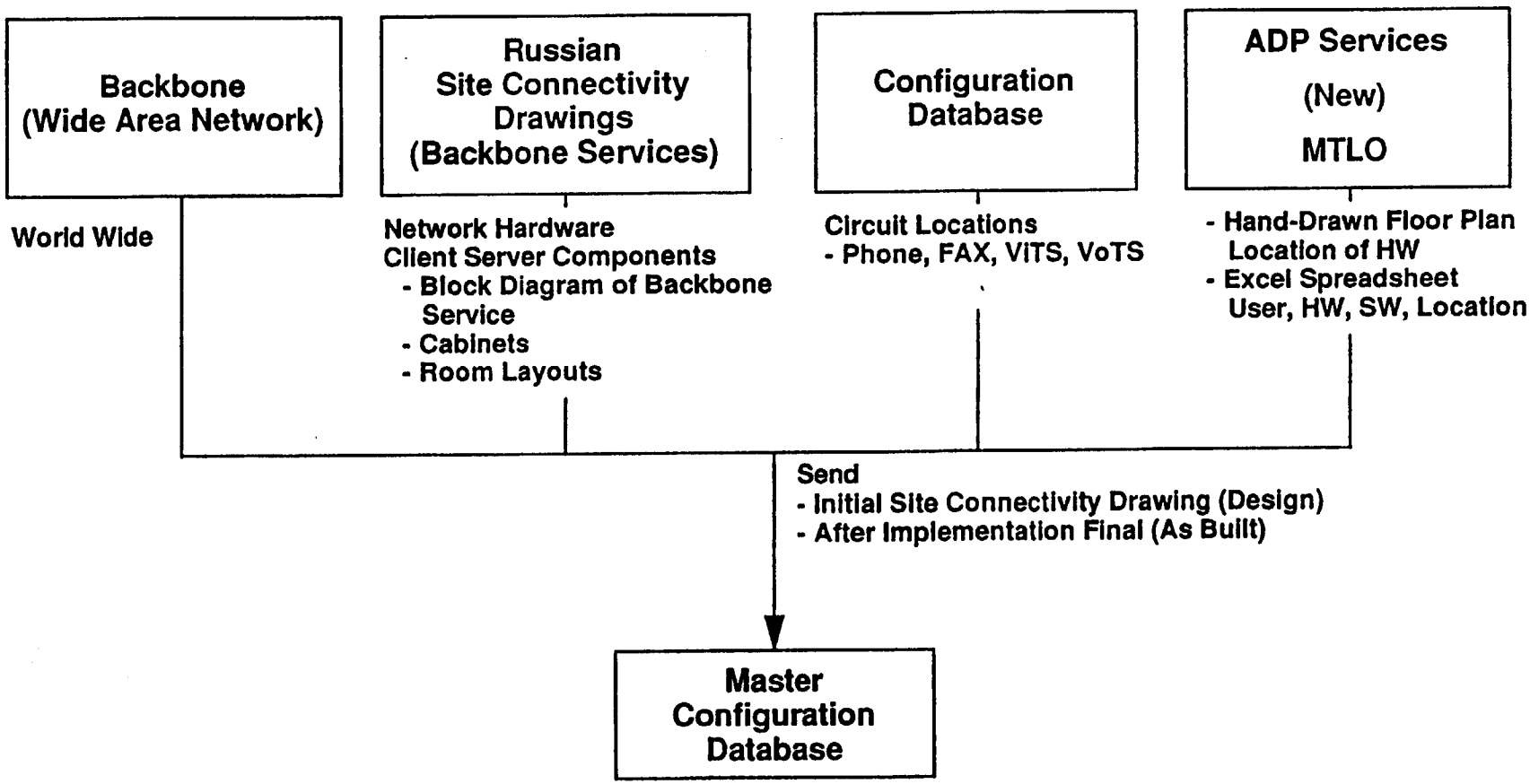


NSI Requirements Collection and Interfaces With PSCN



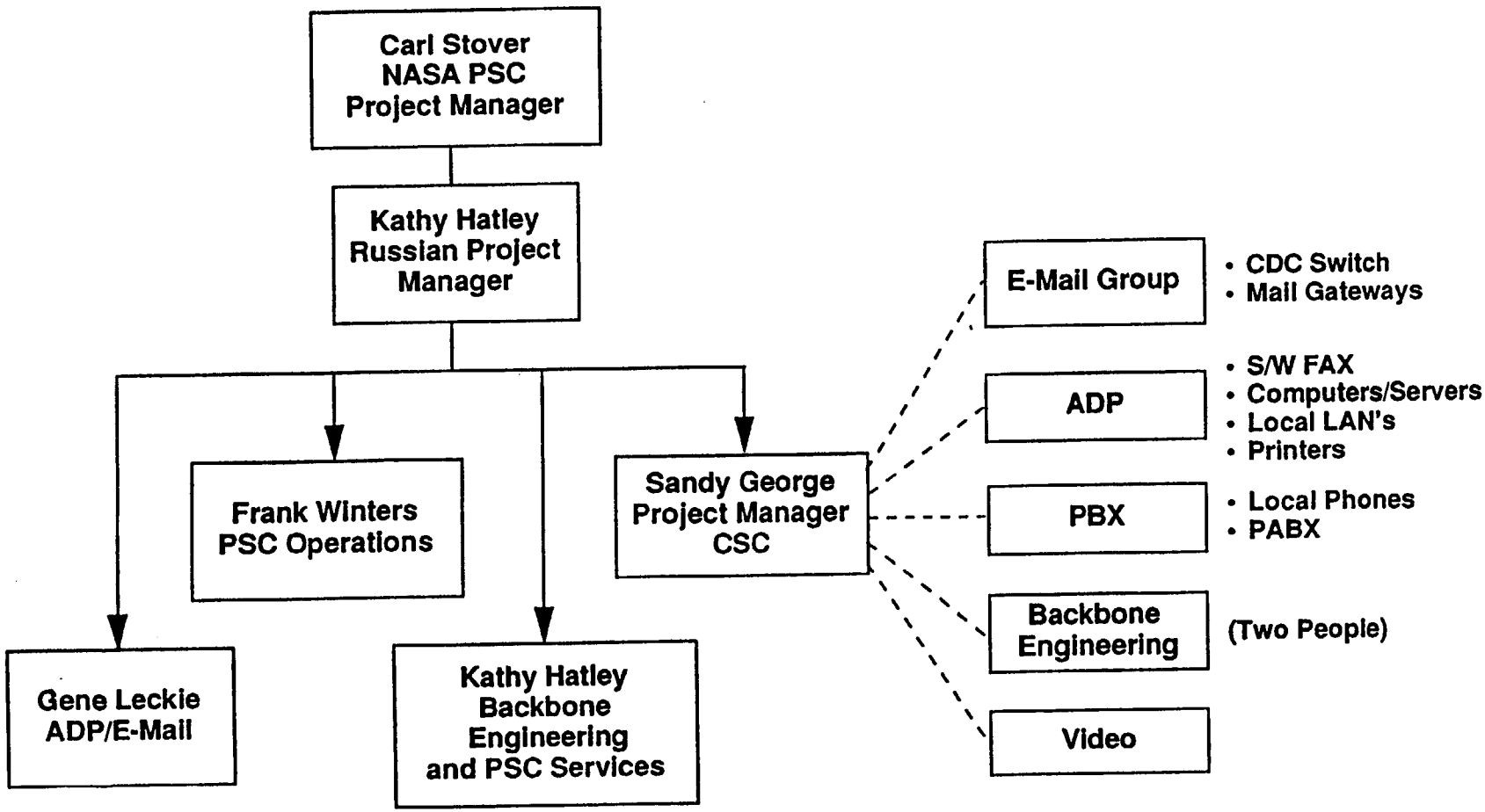
Configuration Management Documentation Process

RUSSIA



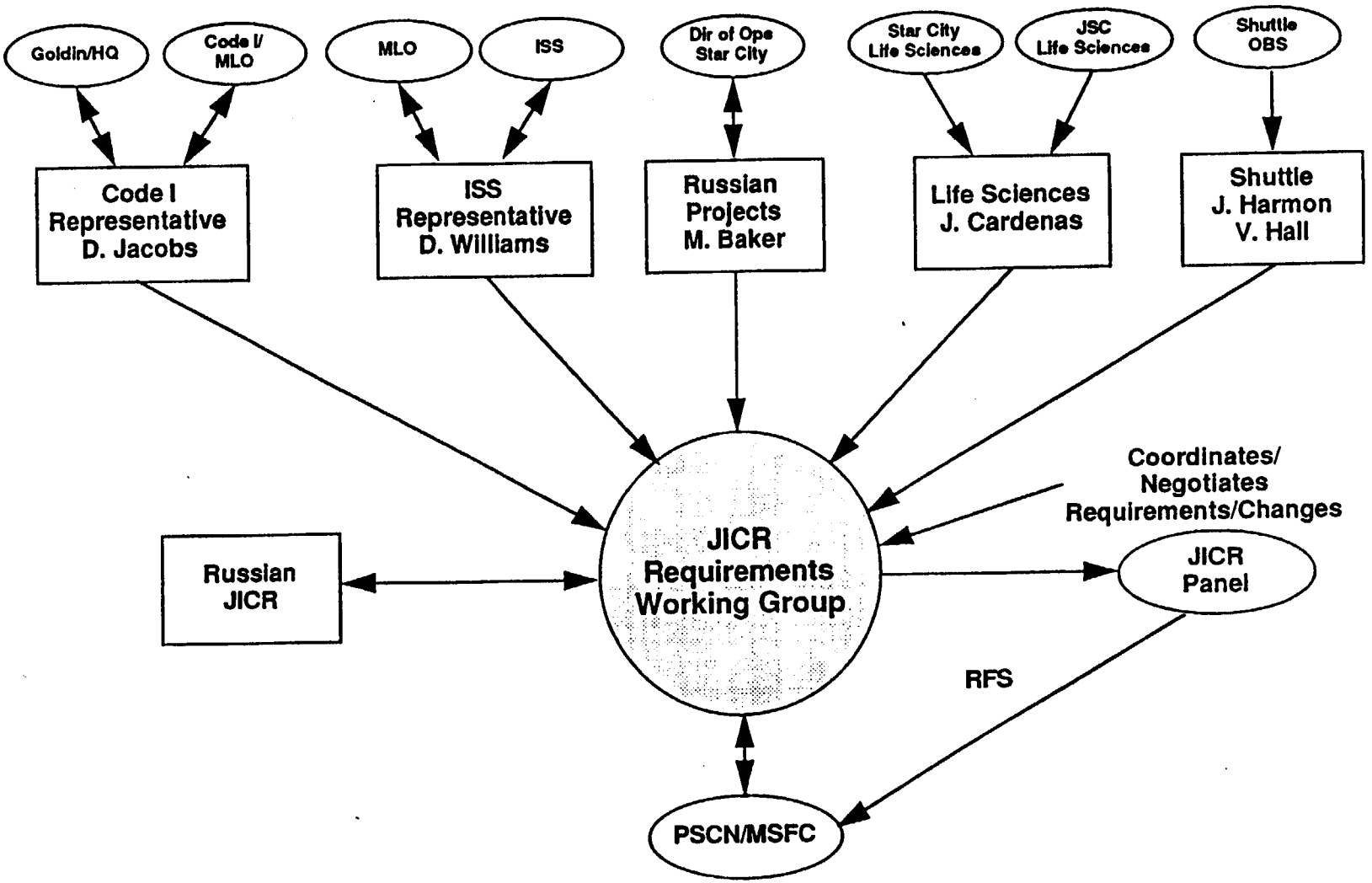
Network Management Configuration System (NMCS)

Management Structure Russian Project

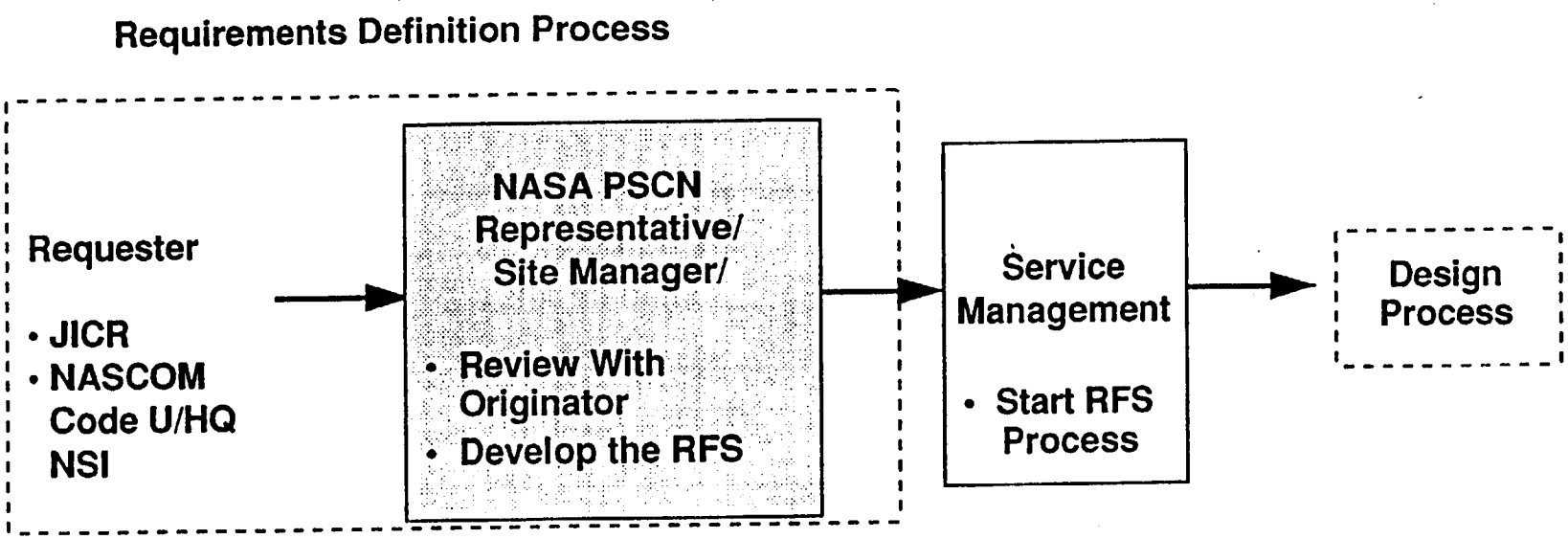


Mission has highest priority. Other priority is given by the requirements panel.

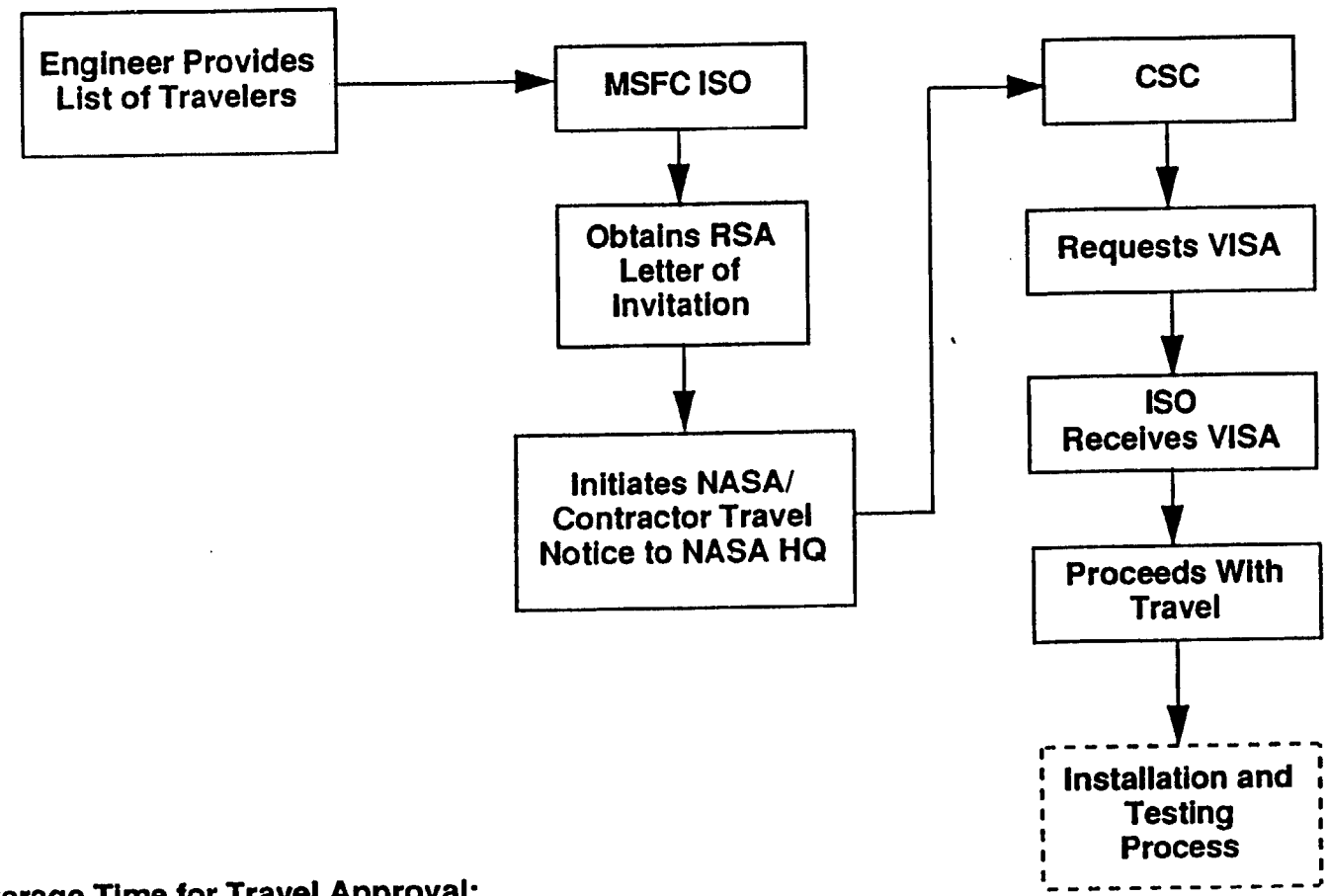
Joint Institutional Communications Requirements Process (JICR)



Service Management Process



Travel Preparation Process



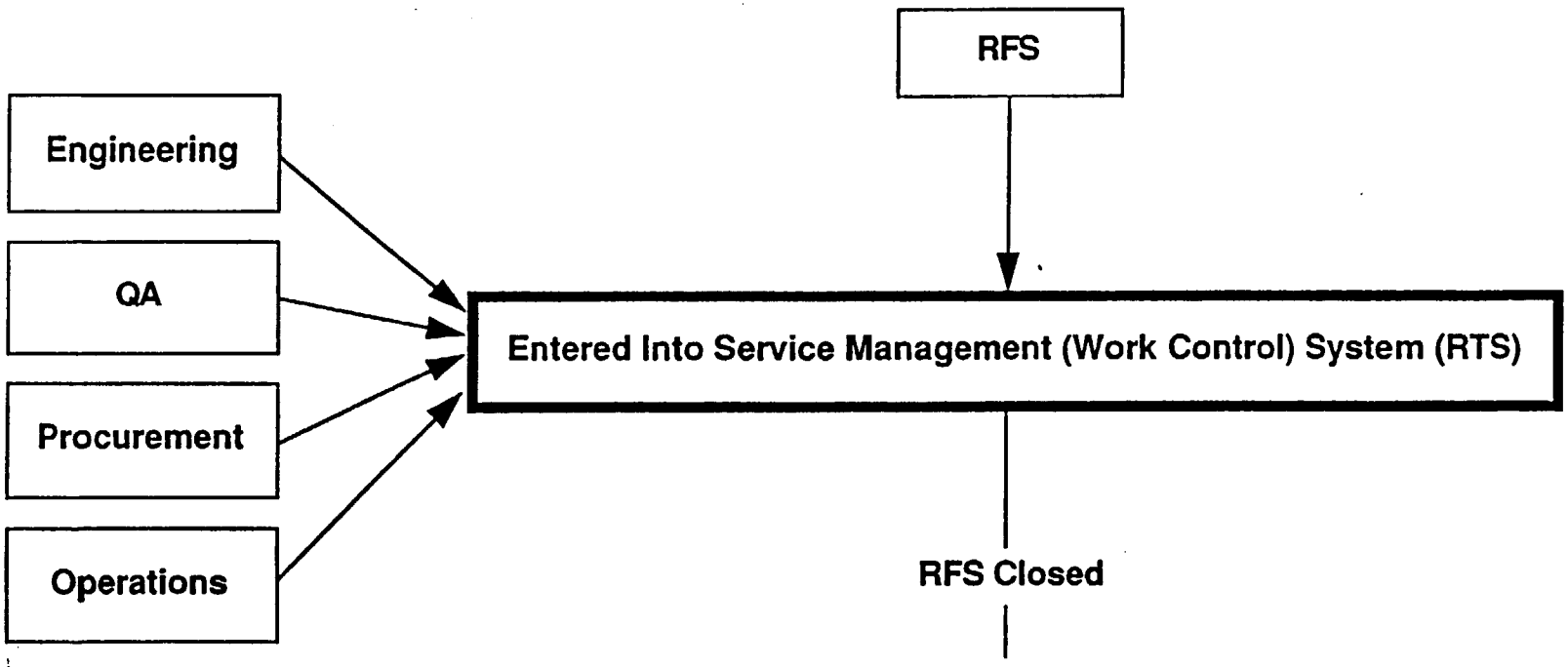
Average Time for Travel Approval:

1 Month - Letter of Invitation and NASA HQ

7 Days - VISA Processing (3 days if the extra charge is paid)

RFS Traceability Process

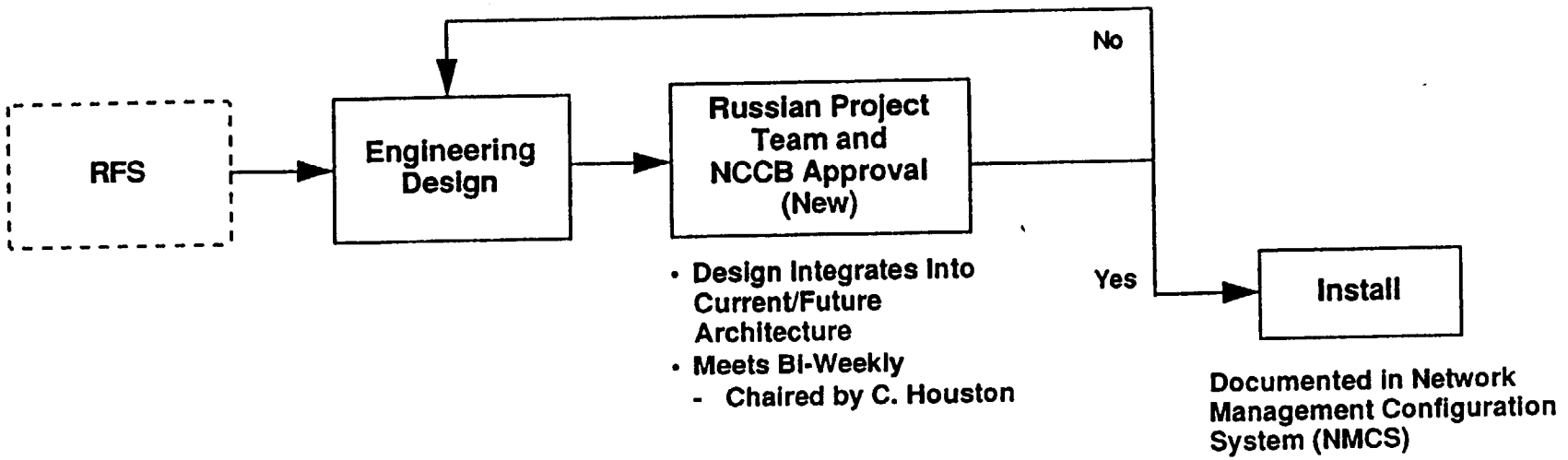
RTS STATUS INPUT



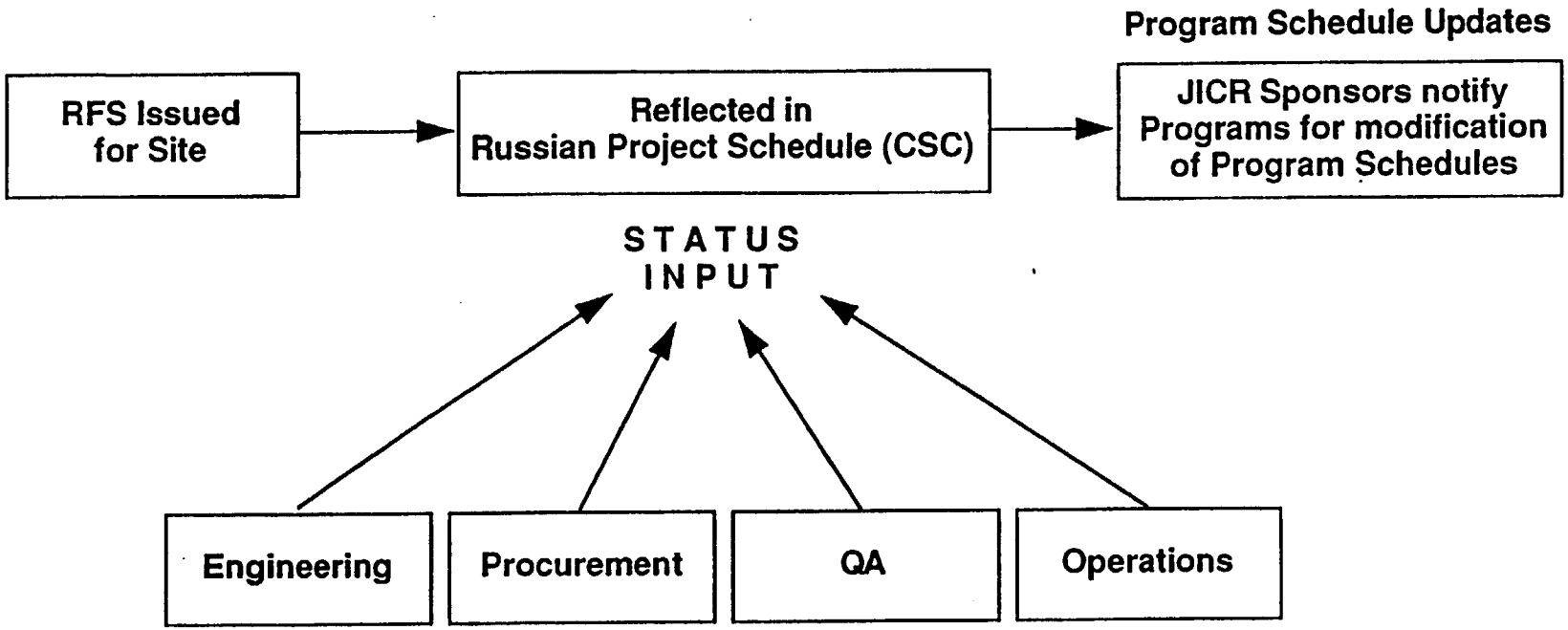
- RFS History Data Remains in RTS
- Reports Available Sorted on Various Fields
- RFS-Specific Data May Reference Other RFS's for Traceability
- Completed Work Package Available From Work Control

Configuration Control Process

RUSSIAN ADP/T DESIGN APPROVAL FLOW



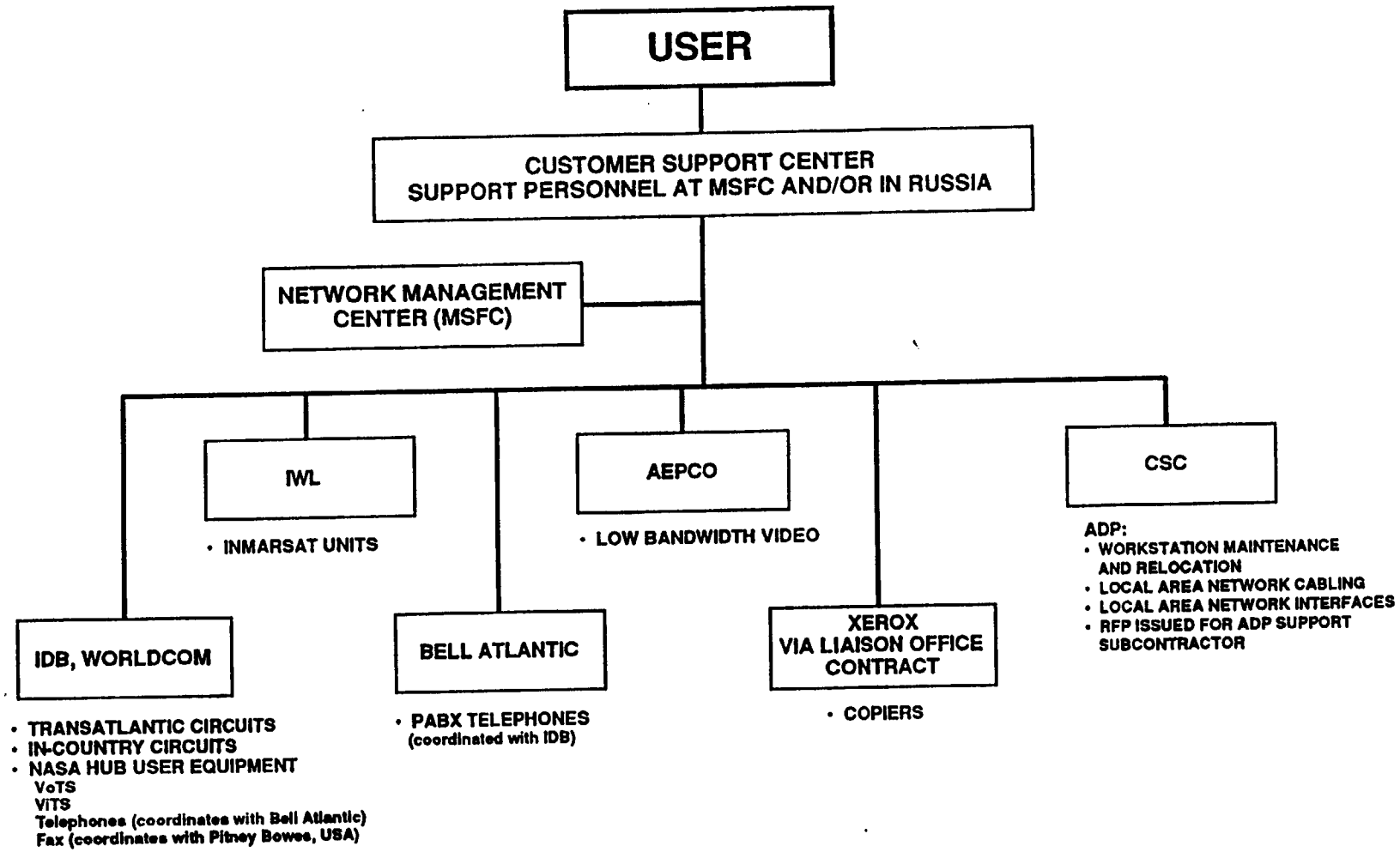
Schedule Interfaces Process



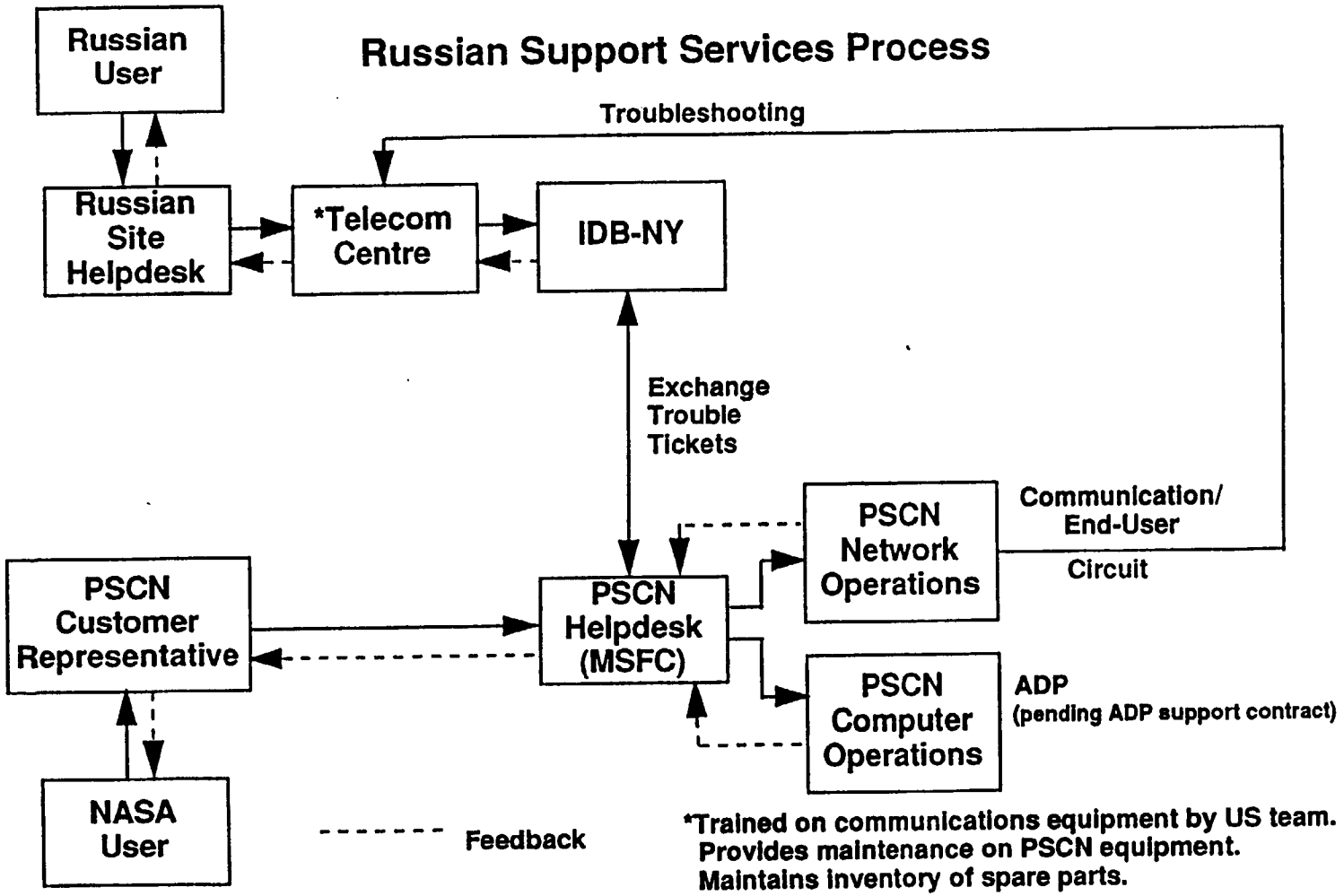
- Weekly Meeting With All Organizations (Update Schedule)

Sustaining Operations and Maintenance

RUSSIAN OPERATIONS AND MAINTENANCE SUPPORT INTERFACES



Sustaining Operations and Maintenance



Appendix 5

Implementation Plan for NASA Telecommunications and ADP/LAN Requirements to Russia, June 8, 1995

IMPLEMENTATION PLAN

FOR

NASA TELECOMMUNICATIONS AND ADP/LAN

REQUIREMENTS TO RUSSIA

Marshall Space Flight Center

Program Support Communications Project Office

June 8, 1995

The plan for implementation of telecommunications and ADP/Local Area Network (LAN) requirements to Russia by the MSFC PSCN Project is comprised of five elements described as follows:

I. Management Plan

A plan for project management of extension of the PSCN backbone into Russia was created in response to receipt of requirements for network connectivity by several NASA project offices. These project offices' requirements were to support joint endeavors between NASA and Russian counterparts for science research and manned space flight, pursuant to Cooperative Agreements signed by the U.S. and Russian Presidents.

II. Joint U.S./Russia Institutional Communications Requirements Document

This document identifies telecommunications and ADP/LAN support requirements between NASA and Russian counterparts as agreed to by a joint (JICR) working group. The JICR is co-chaired by NASA, B. Waddell, and a Russian Space Agency representative, V. Grigoriev. The working group includes membership from project offices and a PSCN project representative. This group will manage and control programmatic requirements for telecommunications and ADP/LAN requirements between NASA and Russian locations. The baseline document, and future changes thereto, will be provided to the PSCN project from the NASA working group co-chairman.

III. Requirements Priorities

As described in Section II, above, requirements for NASA-Russian telecommunications and ADP/LAN services are received and approved by the JICR. The priority for implementation of the initial baseline listings for locations and services was provided to PSCN from the NASA working group co-chairman. Similar guidance will continue to be provided for future changes to service requirements.

IV. Comprehensive Listings of RFS's

While the JICR document described in Section II, above, describes coordinated NASA-Russian program agreements for telecommunications and ADP/LAN support requirements, the implementation of specific requirements requires a Request for Service (RFS), which identifies the schedule need date, funding authority, and other site-specific information needed for the PSCN Project Office to proceed. A comprehensive listing of RFS's for implementation of NASA-Russian services is maintained for the Russia Project.

V. Project Implementation Schedules

Implementation schedules are prepared and maintained which reflect design, procurement, installation, and operational readiness for new services to Russia. Current revisions/copies of the PSCN Implementation Plan elements to deliver telecommunications and ADP/LAN services to Russia are attached.

C. C. Stover
PSC Project Manager

Attachments

Appendix 6

ADP/T Team Shuttle-Mir Task Force
Source Data Book

ADPT/T TEAM
SHUTTLE-MIR TASK FORCE
SOURCE DATA BOOK

TABLE OF CONTENTS

ITEM NUMBER	TITLE
FORMAL	
F-1	Implementation Plan for NASA Telecommunications and ADP/LAN - Requirements to Russia
F-1.1	Management Plan for NASA-PSCN Telecommunications Services to Russia
F-1.2	Joint U.S./Russia Institutional Communications Requirements Document dated May 23, 1995
F-1.3	Requirements by Program Office
F-1.4	Priorities for Russian Communications Installations
F-1.5	Russian Project Schedule dated June 7, 1995
F-2	IDB Statement of Work
F-3	IDB CDR - Phase B
F-4	Program Support Communications Requirements Document (PSCRD), Volume III Part A, Future Requirements (Headquarters Code D)
INFORMAL	
I-1	JICR Working Group Agenda dated April 26, 1995
I-2	Minutes of JICR dated April 26, 1995
I-3	Project Schedule - Russia RFS's CSC/NASA dated April 25, 1995
I-4	Russian Project Status as of May 11, 1995
I-5	Requirements for Network, MCC Communications Systems, Ground Facilities and Consulting Groups for Joint USA/Russia Manned Spaceflight
I-6	Russian Requirements (MTLO)
I-7	Sample Requirements Traceability System (RTS)
I-8	PSCN Communications Drawings

ITEM NUMBER	TITLE
LETTERS	
L-1	Letter from Wayne Littles to Officials in Charge of Headquarters Offices; Directors, OSF Field Installations; Phase 1 Program Manager dated April 17, 1995
L-2	Letter from Tommy Holloway (Code YA), Subject: Establishment and Authorization of the Russian Communications Requirements Panel dated December 20, 1994
L-3	Letter from Bradford Parkinson to Lt. General Thomas P. Stafford dated April 7, 1995
L-4	Letter from Lt. General Thomas P. Stafford to Bradford Parkinson dated June 6, 1995
PRESENTATIONS	
P-1	NASA PSCN Russian Project Overview
P-2	International Initiatives/Activity
P-3	Russian Institutional Communications Requirements

Appendix 7

Acronym List

Appendix 8

Task Force Members

Task Force on the Shuttle-Mir Rendezvous and Docking Missions

Chairman
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